RAILWAY ENGINEERING
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Vol. VI | *Chicago* | OCTOBER, 1910 | *New York* | No. 10

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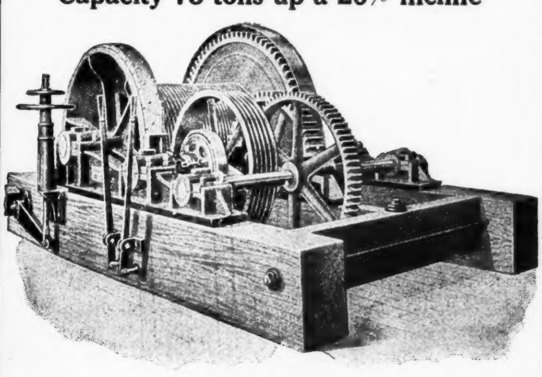

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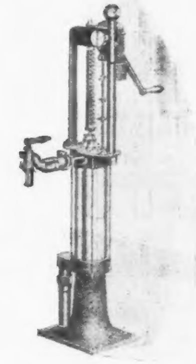

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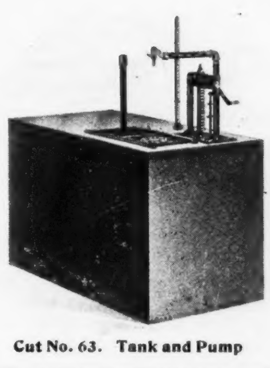

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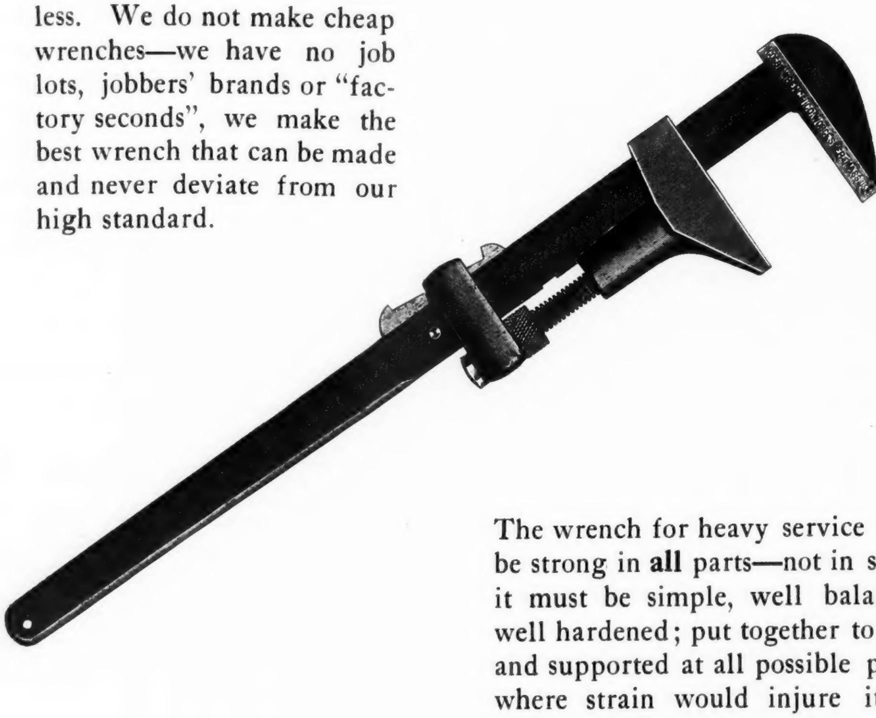

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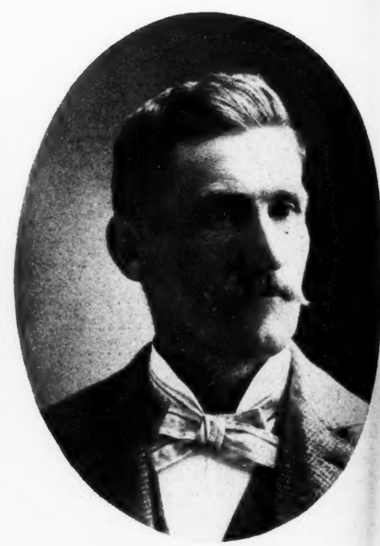

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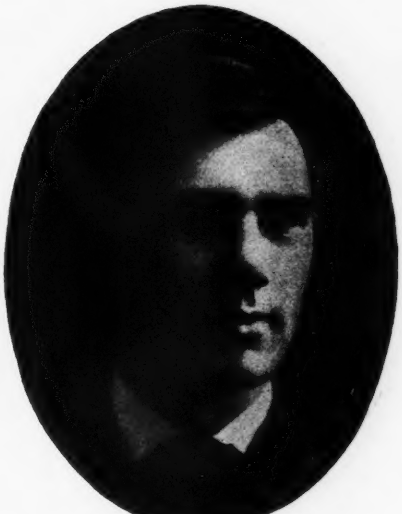

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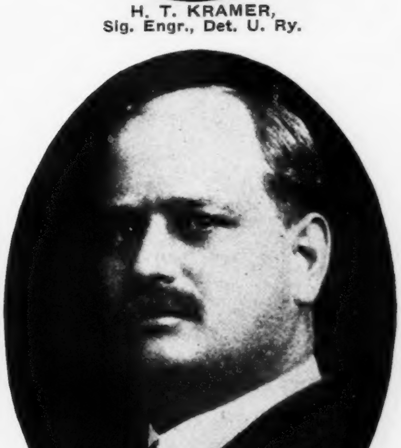

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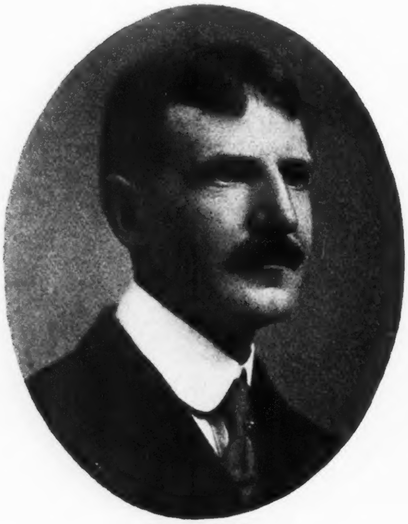

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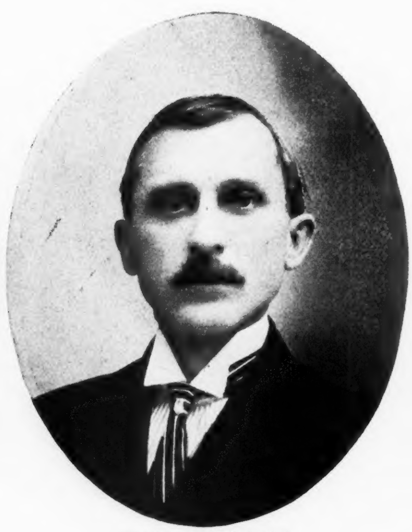

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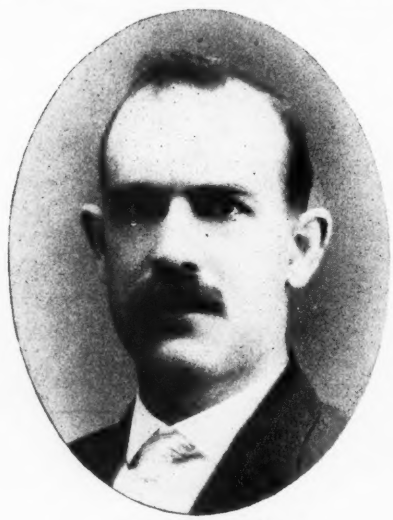

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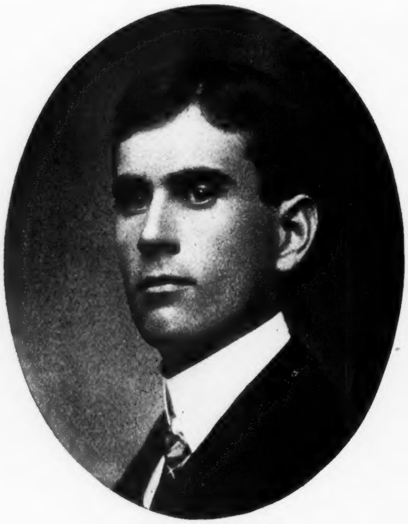

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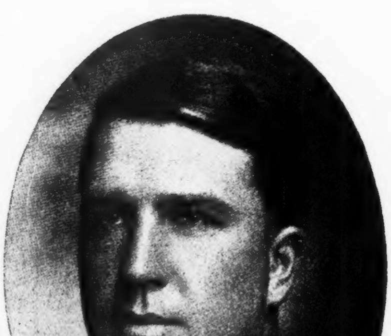

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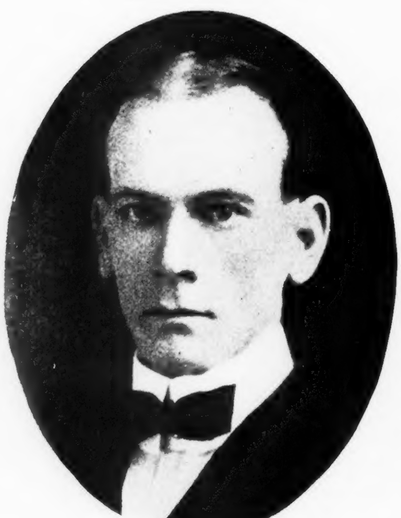

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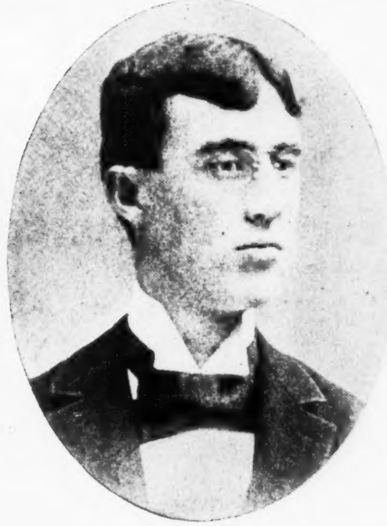

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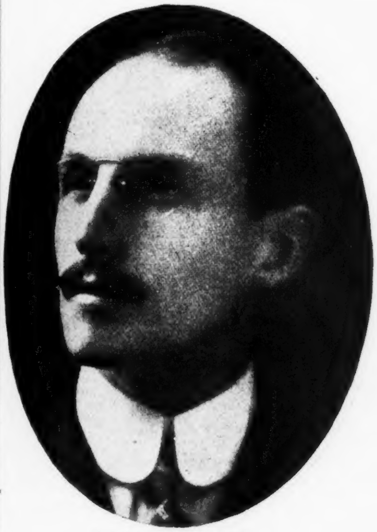

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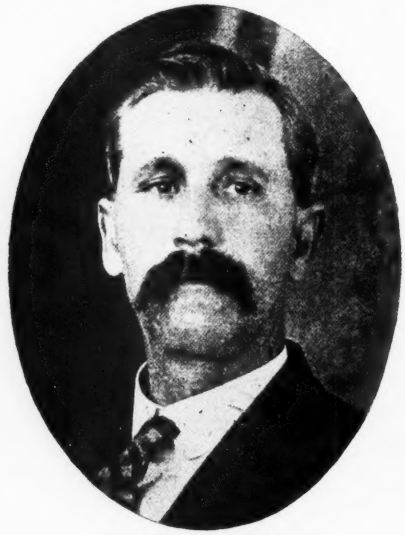

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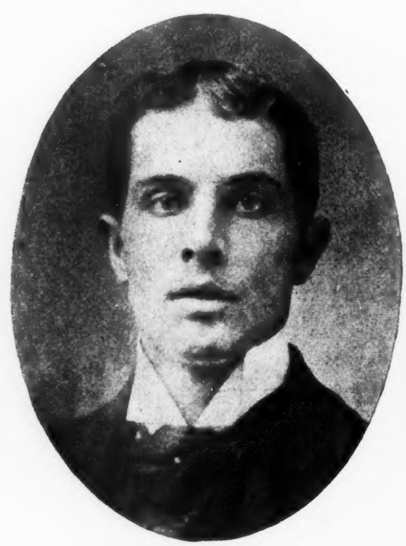

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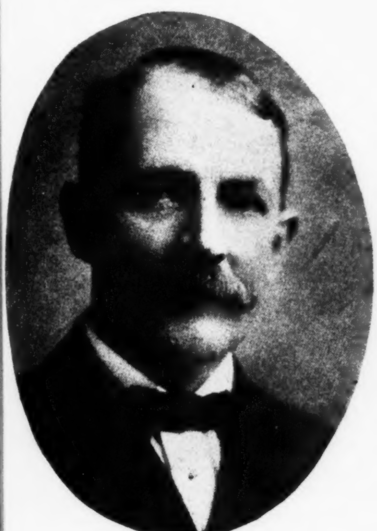

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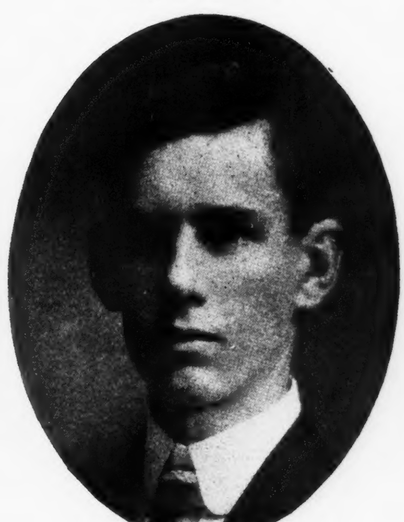

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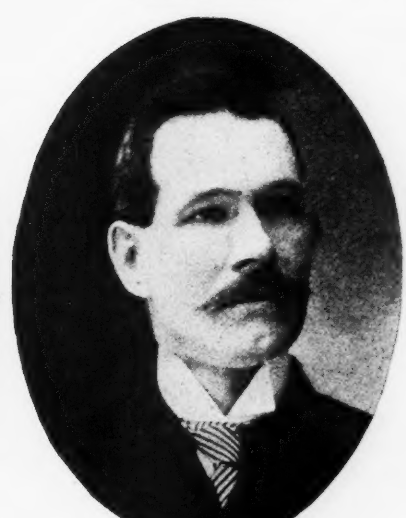

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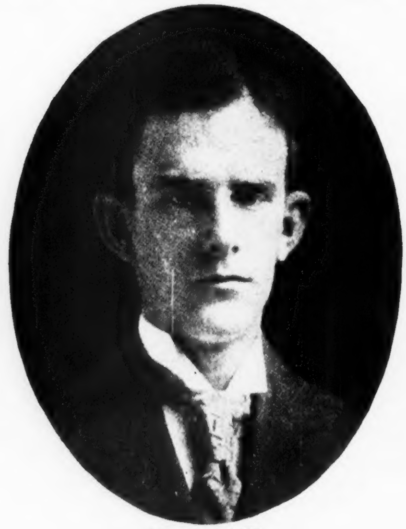

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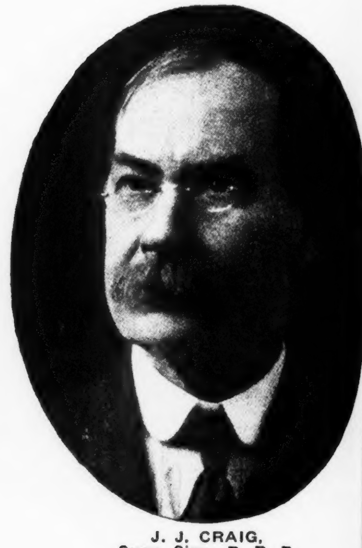

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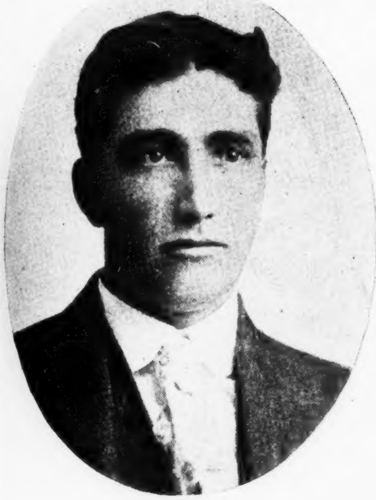

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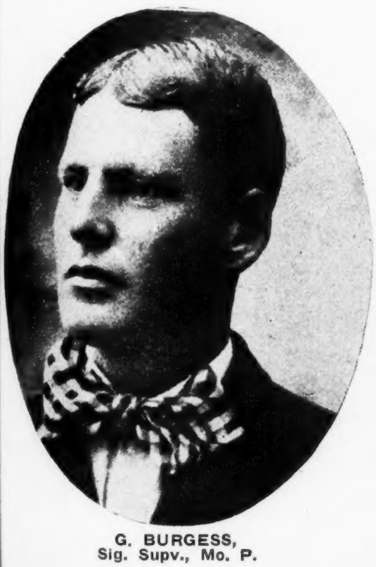

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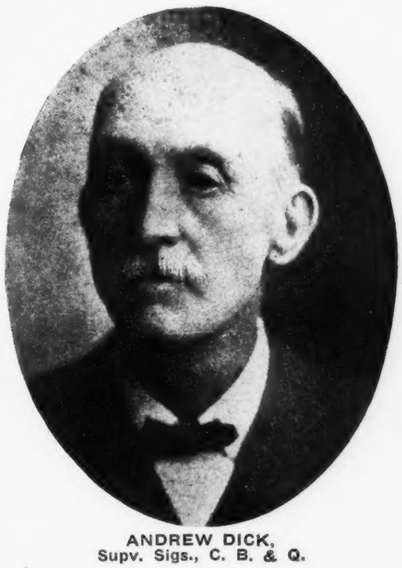

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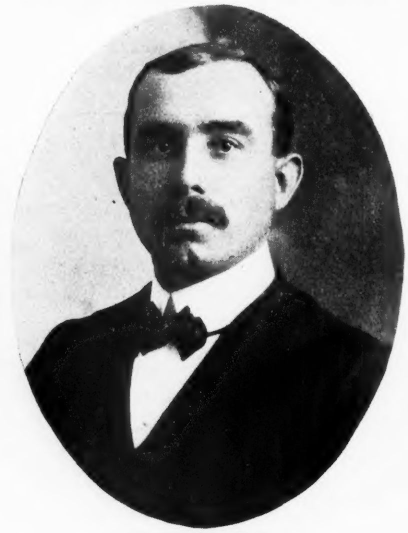

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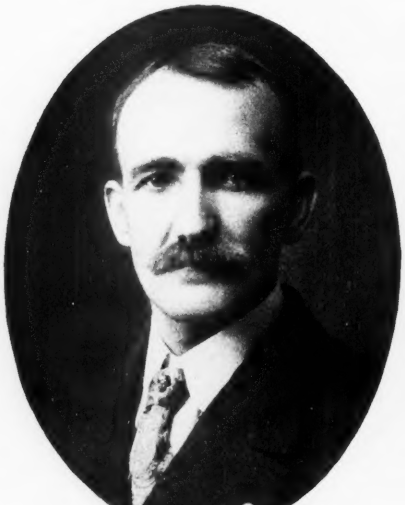

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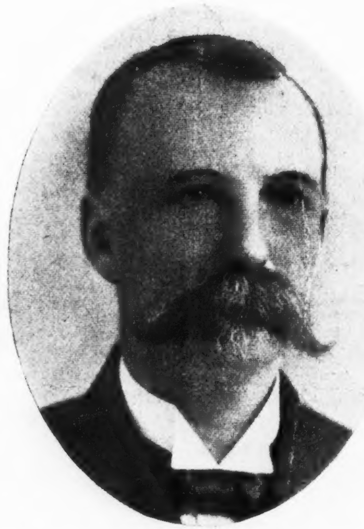

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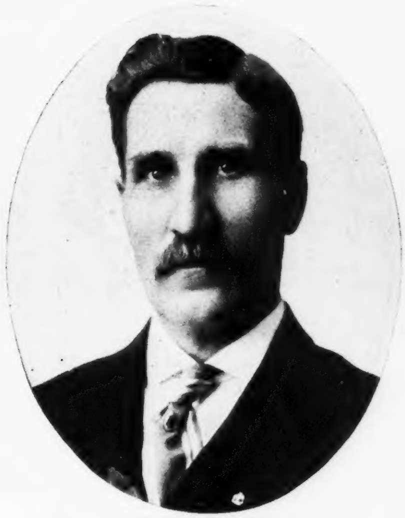

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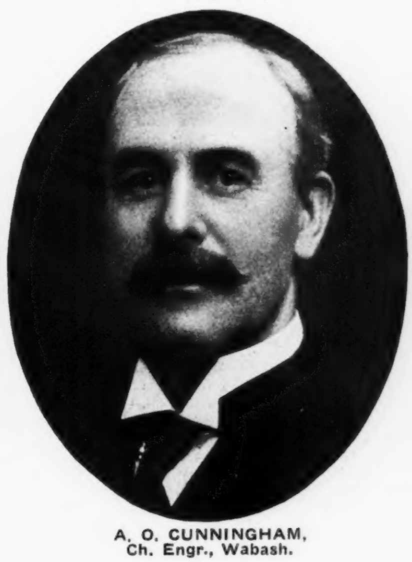
Engr. Const., Santa Fe.

T. C. BURPEE,
Engr. M. of W., Intercolonial Ry. of Canada.



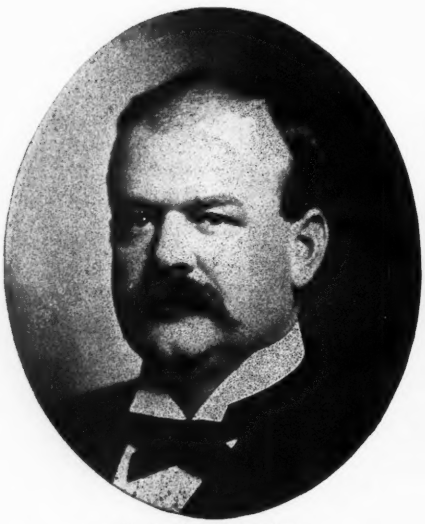
A. O. CUNNINGHAM,
Ch. Engr., Wabash.

W. H. FINLEY,
Asst. Ch. Engr., C. & N. W. M. Com. No. 3,
Am. Ry. B. & B. Assn.

J. E. GREINER,
Cons. Engr.

E. N. LAYFIELD,
Div. Engr. B. & O., Chicago Terminals.

C. F. LOWETH,
Engr. & Supt. B. & B., C. M. & St. P.



W. A. McGONAGLE,
Pres. & Gen'l. Mgr., D. M. & N.; Past. Pres. Am. Ry. B. & B. Assn.

F. E. SCHALL,
Bdg. Engr., L. V.; Second Vice Pres. Am. Ry. B. & B. Assn.

J. P. SNOW,
Ch. Engr., B. & M.; M. Com. No. 6, Am. Ry. B. & B. Assn.

W F. STROUSE,
Asst. Engr., B. & O.; M. Com. No. 8, Am. Ry. B. & B. Assn.

I. O. WALKER,
Asst. Engr., N. C. & St. L.

K. J. C. ZINCK,
Asst. Chief Engr., G. T. P.

R. J. AREY,
Engr., Santa Fe.

J. S. BROWNE,
Div. Engr., N. Y. N. H. & H.

H. RETTENHOUSE,
Div. Engr., C. & N-W.; First Vice Pres. Am. Ry. B. & B. Assn.

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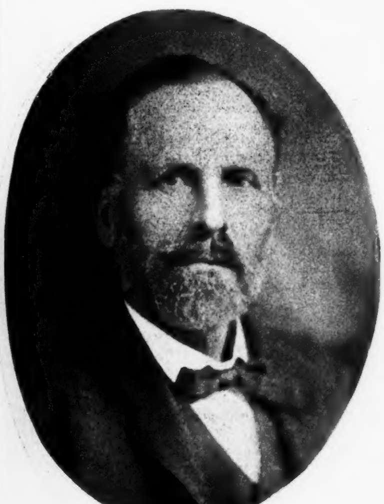
Supv. B. & B., So. Pac.

JAS. HARTLEY,
Supt. B. & B., No. Pac.

A. H. KING,
Supt. B. & B., O. S. L.



J. F. PARKER,
Gen'l. Fore. B. & B., Santa Fe.

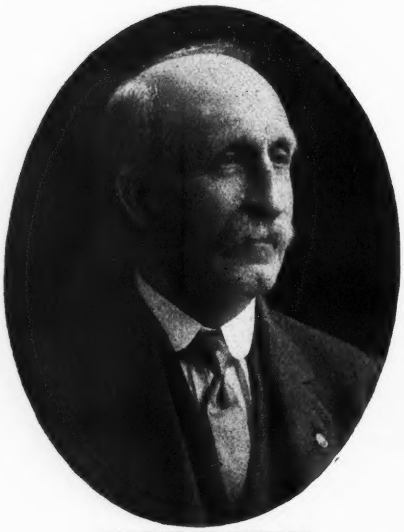
E. C. GEORGE,
Gen. Fore. B. & B., G. C. & S. F.

J. B. SHELDON,
Supv. B. & B., N. Y. N. H. & H.; M. Com. Publications Am. Ry. B. & B. Assn.


ALEXANDER AMOS,
Supt. B. & B., Soo Line.


JOHN SCHAFFER,
Supv. B. & B., N. Y. C. & H. R.


E. E. WILSON,
Bdge. Supv., N. Y. C. & H. R.


ALBERT MOUNTFORT,
Supv. B. & B., B. & M.


WM. REED,
Supv. B. & B., I. C.


R. O. ELLIOTT,
Supv. B. & B., L. & N.


LEE JUTTON,
Gen'l. Insp. Bridges, C. & N-W.

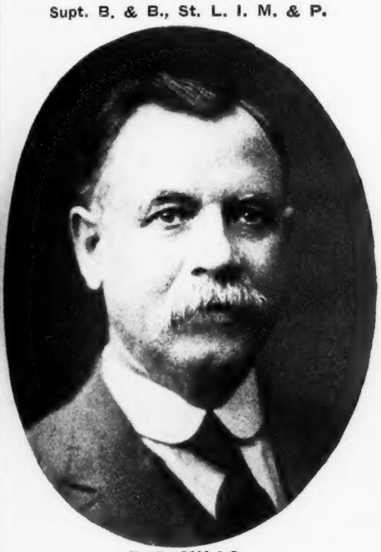

S. F. PATTERSON,
Gen'l. Fore. B. & B., B. &. M.; Past Sec'y.
Am. Ry. B. & B. Assn.


CLAUDE DONALDSON,
Fore. B. & B., Cent. Vt.

ALF. BROWN,
Supt. B. & B., St. L. I. M. & P.

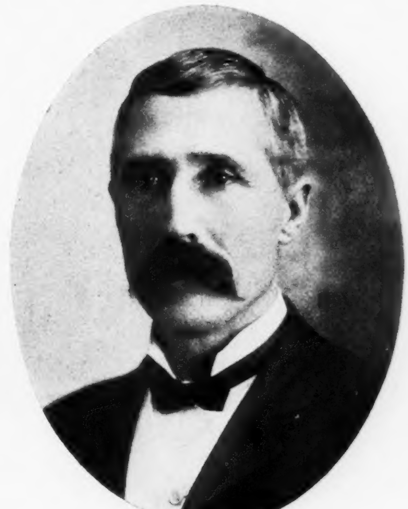
W. T. POWELL,
Supt. B. & B., C. & S.

J. N. PENWELL,
Supv. B. & B., L. E. & W.; Fourth Vice Pres. Am. Ry. B. & B. Assn.



R. P. MILLS,
Supv. Br., N. Y. C. & H. R.

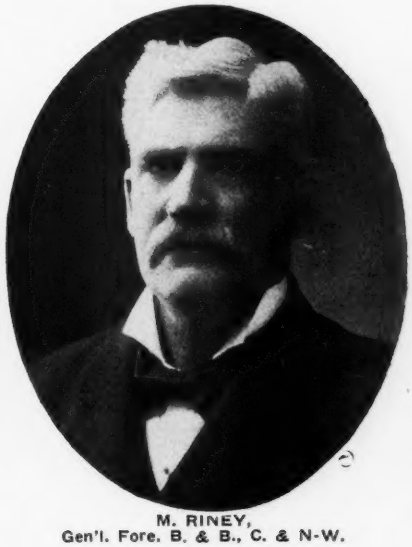
B. J. PICKERING,
Gen'l. Fore. B. & B., B. & M.



G. H. SOLES,
Supv. B. & B., P. & L. E.; M. Com. No. 3, Am. Ry. B. & B. Assn.

R. J. McKEE,
Insp. Br., C. of Geo.

C. E. POWELL,
Supv. B. & B., C. & O.

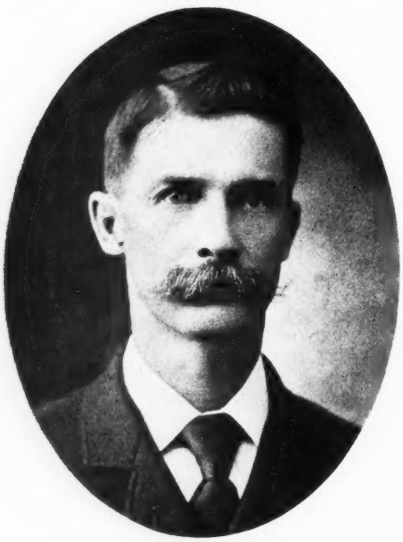


M. RINEY,
Gen'l. Fore. B. & B., C. & N-W.

P. W. CAHILL,
Fore. Docks, S. A. L. M. Com. No. 1, Am. Ry. B. & B. Assn.

BENJ. P. PHILLIPS,
Dist. Fore., N. Y. N. H. & H.

A. E. KILLAM,
Insp. B. & B., Intercolonial Ry. of Canada; Third Vice Pres. Am. Ry. B. & B. Assn.

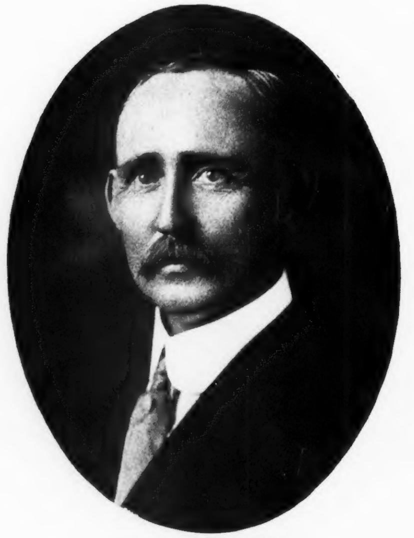


M. F. CAHILL,
Master Carp., S. A. L.

W. W. PERRY,
M. C. P. & R.

J. B. WHITE,
Water Supply Dept., C. & N-W.

H. M. HENSON,
Insp. Masonry, Santa Fe.



W. M. CARDWELL,
Master Carp, Washington Term.

H. C. McKEE,
Supv. B. & B., I. C.

HENRY BENDER,
Fore. B. & B., C. & N.-W.

J. DUPREE,
Gen. Fore. Water Dept., S. I.

B. J. MUSTAIN,
Supt. Const. Water Serv., El Paso & S. W.

GEO. W. REAR,
Gen'l. Bdge. Insp., So. P., M. Com. No. 10,
Am. Ry. B. & B. Assn.

Biographies

Signals.

Edward L. Adams, chief signal inspector for the Lake Shore & Michigan Southern at Cleveland, Ohio, was born December 1, 1878, at Ashland, Mass. He was educated in the public schools of that town and at Brown University, from which he was graduated in 1898. Between that time and his entrance into signal work he was consecutively in the employ of the General Electric Company, the Gould Storage Battery Company and the Electrical Engineering department of the Boston Elevated. In 1902 he became engaged in signal work on the Baltimore & Ohio, where he remained for two years. At the end of that period he was appointed to his present position.

C. C. Anthony, assistant signal engineer, Pennsylvania, at Philadelphia, was born September 23, 1863. His first experience in signal work was obtained in connection with the installation of the controlled manual block system on the New York Central, beginning with the Johnson Railroad Signal Company in 1892 and continuing with the Union Switch & Signal Company on the same work He was then made signal electrician, New York Central & Hudson River, maintaining the block system. On the Pennsylvania Railroad he has been successively signal repairman, foreman of signals, supervisor of signals, inspector of signals, assistant signal engineer.

C. L. Bartholome, signal inspector, was born at Evansville, Ind., September 20, 1883. He graduated from Purdue University, June, 1905. He entered the service of the Pennsylvania Lines West on the Pittsburgh division as repairman, July 26, 1905, and was transferred to the Cleveland & Pittsburgh division, October 1, 1906; while on the Pittsburgh division he held positions of repairman, wireman, draughtsman and inspector. He became signal foreman on the C. & P. and was transferred to the Logansport division as signal supervisor, April 1, 1907. On November 1, 1907, he was transferred to the Indianapolis division as signal supervisor, and was transferred to the general office April 1, 1909, as signal inspector, which position he now holds.

G. E. Beck, supervisor of signals of the Lake Shore & Michigan Southern at Toledo, Ohio, was born at Hillsdale, Mich., April 27, 1876. He received a common school education at Jackson and entered signal work in November, 1898, as blacksmith on construction and general repair work for the Michigan Central. In August, 1901, he went in the same capacity to the L. S. & M. S. at Toledo, Ohio, was made foreman in March, 1902, and was transferred to the maintenance of the Polk St. electric interlocking plant at Chicago in July, 1903. In November of the following year he was appointed assistant supervisor of signals at Elkhart, Ind., and in 1906 was made supervisor of the Michigan Signal District, which position he now holds.

C. N. Beckner, supervisor of signals for the Norfolk & Western, at Welch, W. Va., entered the signal department of this road in 1903 as maintainer. During the following two years he was promoted from time to time until in 1905 he was appointed supervisor of signals. He resigned, in 1906, to accept a position with the Santa Fe as signal foreman; and in 1908 returned to the Norfolk & Western, taking up his former duties as supervisor of signals, which is his present position.

E. A. Black, signal supervisor of the Lake Shore & Michigan Southern at Ashtabula, Ohio, was born in Andover, Ashtabula County, Ohio, in 1851, where he received a common school education. In 1871 he was appointed superintendent of a manufacturing plant and remained in this position until 1880, when he started a hardware business. Being compelled by a serious illness to give up this business he sold it out and in 1885 entered the service of the Lake Shore on the Franklin division. After two years he was made foreman tinner with headquarters at Ashtabula. In 1889 he was transferred to Cleveland and from then until 1893 he was engaged in interlocking work in connection with his other duties. In the latter year he was made foreman of interlocking. In 1904 he was appointed to his present position as supervisor of signals.

George Boyce was born March 2, 1868, near Parkhill, Ontario, and was educated in public and high schools there, and learned telegraphy. He entered the service of the Grand Trunk August 31, 1885, as telegrapher, remaining with that company and in that capacity fourteen months. He then entered the service of the telegraph and signal department of the C. St. P. M. & O. October 31, 1886, filling consecutively the positions of telegrapher, wire chief, secretary to superintendent of telegraph, acting chief telegrapher and chief clerk. He was appointed signal engineer October 1, 1900, and superintendent of telegraph and signals April 1, 1909.

J. H. Broadbent was born in Alton, McKean County, Pa., on August 7, 1878, and attended public school in McKean and Jefferson counties until he was 12 years old, when he left school and started to work in the bituminous coal mines, following this occupation until he was 25 years old. In the summer of 1903 he left the coal mines and on August 7 of the same year entered the service of the Middle division of the Pennsylvania as a laborer in the signal department. In December he was transferred to the Schuylkill division as signal repairman. Two years later he was appointed signal foreman of this division, and on December 15, 1906, was appointed assistant supervisor of signals of the West Jersey & Seashore. His appointment as assistant supervisor of signals of the the Allegheny division come on July 10, 1908. On February 1 of the following year he was appointed supervisor of signals for this division, which position he now holds.

G. Burgess, signal supervisor of the Missouri Pacific at Kansas City, was born in Emporia, Kans., January 3, 1879. He attended the public schools at Atchison, Kans., and at the age of 18 entered the service of the Missouri Pacific in the bridge and building department, remaining until 1900. Until 1905 he worked in connection with structural iron building construction, which took him into all parts of the United States and Mexico. In August, 1905, he became signal repairman for the Missouri Pacific. He was thus engaged until 1908, when he was appointed signal supervisor.

L. E. Carpenter, supervisor of signals of the Williamsport and Susquehanna divisions, Pennsylvania railroad, was born in Wayne County, Pennsylvania. His early education was received in the public schools and the Keystone Academy, Factoryville, Pa. He began work as carpenter in 1895, continuing at it three years. He was graduated from the Pennsylvania State College, 1902 (mechanical engineering). Vacations during college course were spent with the Rogers Locomotive Works at Paterson, N. J., and at construction work for the Union Switch & Signal Co. He entered the draughting room of latter company July, 1902, became foreman of mechanical draughting, October, 1904, and was appointed assistant superintendent of signals of New York division, P. R. R., July, 1905, and acting supervisor of signals on that division from August, 1908, to July, 1909, when he was appointed to present position.

Daniel Cathers, supervisor in charge of the signal and water supply departments of the Evansville & Terre Haute, was born on July 4, 1862, in Martin County, Indiana. In September, 1886, he was employed by the E. & T. H. as house carpenter, and later was transferred to the bridge department as assistant foreman. In 1907 he was made foreman in the building and painting department, being made supervisor within a short time.

G. W. Chappell, mechanical inspector on the staff of the signal engineer of the New York, New Haven & Hartford, was born at Booth's Corner, Delaware County, Pennsylvania, November 7, 1868. He began railroad work in March, 1887, and for the next five years was employed as telegraph operator on the Pennsylvania, the Long Island, and the N. Y., N. H. & H. He entered the service of the signal department of the latter during the year 1892, where he has been consecutively chief clerk, supervisor of interlocking, supervisor of signals, and inspector on the signal engineer's staff. He was appointed to this position in July, 1908.

Jas. H. Cormick, signal inspector of the Northern Pacific at St. Paul, was born in Boston, Mass., in November, 1871. He begun signal work as a laborer for the Union Switch & Signal Co. in the summer of 1890, and later in the same year was made batteryman for the same company on the Boston & Albany. After serving two years as batteryman and maintainer he was turned over to the B. & A. as maintainer and remained in this position for five years. He then became general foreman for the American Automatic Switch & Signal Co., of Boston, and, after completing the work for which he was engaged, accepted a position in the signal department of the Fitchburg, now part of the Boston & Maine. Severing his connection with this company, after some little time, he became signal inspector on the Providence division of the N. Y., N. H. & H. From there he went to the Boston Elevated, being engaged on their electro-pneumatic interlocking and signal work. Later he was a maintainer for the Interborough Rapid Transit Co. in New York. Following this he was assistant electrical engineer for the United States Government, and later was in the engineering department of the Hall Signal Co. at Garwood, N. J. Later he accepted a position in the engineering department of the General Railway Signal Co. at Rochester, N. Y., and then became supervisor of signals for the Hudson Companies in New York City. Some time ago he was appointed to the position of signal inspector for the Northern Pacific Railway, which position he now holds.

John J. Craig, supervisor of signals on the Middle division

of the Pennsylvania, was born July 17, 1845. He began railroad work as a carpenter for the Pennsylvania in 1873. In 1883 he became foreman, and later was put in charge of the interlocking and signaling between Harrisburg and Altoona, Pa., on the Middle division, with headquarters at Altoona.

G. W. Dane started on signal work in 1885 under the late G. D. Fowle—then assistant signal engineer of the P. R. R. —on the N. G. division of that road, and was made foreman and general foreman of interlocking successively. He resigned in 1892 to enter the employ of the Johnson Signal Co. as foreman of construction and remained with that company until the fall of 1895, when he resigned and took service with the National Switch & Signal Co. in the same capacity until that company was taken over by the Union Switch & Signal Co. He continued with the latter as foreman and general foreman on mechanical and electro-pneumatic interlocking and automatic block signal work, until the fall of 1908. He then entered the service of the South Side Elevated, Chicago, as superintendent of interlocking, a continuous service of 25 years of signal work.

Andrew Dick, supervisor of signals of the Chicago, Burlington & Quincy, served a full apprenticeship as machinist and marine engine builder in England. Coming to America he became associated with the Burlington as gang boss in building locomotives in 1865. In 1888 he was appointed to his present position.

E. B. Dodd, general foreman of telegraph and supervisor of signals of the Minneapolis, St. Paul & Sault Ste. Marie, has been employed in the telegraph department of the Soo line for the past sixteen years as lineman and general foreman. On January 1, 1907, he was appointed signal supervisor.

W. L. Dryden, signal supervisor of the Baltimore & Ohio, at St. George, N. Y., was born near Roanoke City, Md., on April 23, 1865. He entered the service of the B. & O. August 4, 1884, in the telegraph department at Grafton, W. Va. When the B. & O. acquired control of the S. I. R. T. in July, 1890, he was transferred to the New York division, in charge of the maintenance and construction of the telegraph lines. In April, 1892, the first automatic block signals were put in service on the S. I. R. T. and placed under Mr. Dryden's supervision. He has been in charge of signals since then and is now in charge of all telegraph, telephone and electric light work, as well, on the New York division of the B. & O.

W. J. Eck, electrical and signal engineer of the Southern railway, entered railway service in 1902 as signal draftsman for the C. &. N.-W. and was promoted to assistant engineer signal department November 15, 1902. He held that position until July 1, 1907, when he was appointed to the position he now holds. Before entering railroad service Mr. Eck graduated from the Iowa State College and engaged for several years in telephone work at various points in the West and served as chief electrician in the U. S. army transport service. He is a member of the Railway Signal association, the American Railway Engineering and Maintenance of Way association, and one of the charter members of the Car Lighting Engineers' association. He is chairman of the committee on Signal Education for the Railway Signal association.

Edward Allen Everett was born June 29th, 1872, at Davis, Michigan. In March, 1892, he entered the service of the Michigan Central when the only territory protected by block signals was that between Detroit and Wayne, a distance of about 14 miles, on which, signals of the Hall disk type, operated by track instruments, were in use. For a number of years he was employed in various capacities, and when the system was extended by the installation of 108 miles of the Union disk signals on which installation he was engaged, he was promoted to inspector, and in 1897 to maintainer in charge of a division. About a year later he joined the office force and shortly after was appointed signal supervisor over the entire block signal territory. In August, 1905, he was appointed acting signal engineer and shortly afterwards signal engineer, which position he now holds with headquarters in Detroit.

Throughout his railroad career, Mr. Everett has been a very active and close student of the art of signaling, deeply interested in new developments and in what other roads are doing and how they are doing it. He has also taken out several patents on devices used in connection with signaling. He is a member of the Railway Signal Association, being on Committee No. 3, power interlocking and Committee No. 4, Automatic Block; also Secretary of the N. Y. C. Lines Signal committee.

M. J. Fox, supervisor of signals of the C., B. & Q. lines west of the Missouri river, was born at Lincoln, Neb., October 12, 1878. His early education was received in the public and high schools of that city and was followed by a course in a commercial college. He entered the service of the Burlington in June, 1897, as a laborer in the building department and was employed in connection with scales and signals. After five years in this work he was made assistant inspector of scales for the Burlington Lines West. Upon the reorganization of the signal department in 1903 he was appointed signal foreman, and four years later, in 1907, became general signal foreman. In January, 1908, he was appointed supervisor of signals.

Waldo F. Follett, electrical inspector of the New York, New Haven & Hartford, was born in 1872. At the age of 20 he entered the telegraph department of the New York, New Haven & Hartford. In 1893 he was transferred to the car department and was put in charge of the wiring of cars, in which capacity he served for five years, resigning in 1898 to enter the employ of the Electrical Manufacturing Co. In 1900 he entered the signal department of the New Haven and held consecutively the positions of signal man, general foreman, electrician and electrical inspector.

Oswald Frantzen was born in Norway forty-three years ago and received his education in a public school. Between the ages of 14 and 19 he was a sailor in the merchant marine service of that country. Coming to America in March, 1887, he worked on rigging, ship building and house building, and in 1889 obtained a position in one of the Union Switch & Signal Company's construction forces, remodeling the interlocking plant in the old Grand Central yard, New York. He continued with that company as switch fitter and afterward as foreman until August, 1894, when he was transferred to the signal department of the New Haven. With that company he has since been employed as switch fitter, assistant foreman, construction foreman, signal inspector, and in July, 1908, was appointed signal supervisor of the Western district, and buildings on the Boston & Maine at Nashua, N. H.

George G. Gaunt, supervisor of signals of the Delaware, Lackawanna & Western, at Binghamton, N. Y., rose from the ranks of the construction forces of the signal department of that road. During the past ten years he has filled the positions of maintainer, inspector, foreman, draftsman and supervisor.

E. D. Hanson entered the service of the Hall Signal Co., March 15th, 1900, and continued with them on construction until October 29, 1901. He was then employed by the Union Pacific as maintainer, in which capacity he served four and one-half years ,and was then charging station foreman for one year, district foreman for one and one-half years, and then signal inspector of the Wyoming division at Cheyenne.

Edward Hanson, signal supervisor, G. C. & S. F., was born on April 8, 1878, at Florence, Kan., and was educated in the public schools at Peabody, Kan. He entered the Santa Fe signal department as helper, May 1, 1899, at

Emporia, Kan. On October 1, 1899, he was transferred to Oklahoma City as signal inspector, Oklahoma division; later he was transferred to Ft. Madison, Ia., and Florence, Kan. On May 1, 1903, he was appointed signal foreman, G. C. & S. F., at Cleburne, Tex., and on March 1, 1905, was made signal supervisor of the G. C. & S. F. lines, with headquarters at Cleburne, Tex.

J. L. Harmsted, supervisor of signals of the Philadelphia, Baltimore & Washington (Pennsylvania), at Wilmington, Del., entered the services of that road as batteryman on the New York division in 1897. He served in this capacity and as repairman on this and the West Jersey & Seashore Railroad until 1902, when he was transferred to the P., B. & W., Maryland division, as signal foreman. Remaining there until December, 1906, he was appointed assistant supervisor of signals of the Central division P., B. & W. In the following year he was promoted to the position of assistant supervisor of signals of the Maryland division, and in 1908 was again promoted to the position he now holds.

W. A. Harrison was born in southern Illinois, where he spent his boyhood on a farm and received a public school education. At the age of twenty he began teaching public school. After a few terms he gave this up and enrolled with the Normal School and Business College at Dixon, Ill. Leaving there, he did factory work in Chicago for a time. His railway service began in the machine shops of the Chicago & Alton, where he worked a little more than a year, then entered the signal department of that road, which was then installing automatic block signals, Joliet to Chicago. He worked in various capacities of mechanical interlocking for about two years and then was transferred to electrical signal work during the installation of automatic blocks, Bloomington to Kansas City.

He left the service of the C. & A. in May, 1905, and took a position with the Missouri Pacific as assistant division foreman of signals. August 1st, 1906, he was appointed to signal supervisor of the Memphis division. November 16, 1907, he was transferred to the Wichita division with headquarters at Wichita, Kans.

L. H. Hassel started in signal work on the C. R. R. of N. J. in 1895 as batteryman, was promoted to maintainer in 1897, which position he held until 1900, when he went with the D., L. & W. as wireman. In 1903 he accepted a position as maintainer on the River division of the N. Y. C. & H. R., remaining with the River division until 1907, when he was promoted to signal inspector on the Harlem division of the same road, which position he now holds.

F. J. Hemphill, signal supervisor of the Rock Island, began signal work with the Queen & Crescent on September 7, 1891, in the construction department, installing automatic block signals between Somerset, Ky., and Chattanooga, Tenn. He was in the service of this road until June 15, 1905, being consecutively maintainer and general foreman in charge of construction and maintenance, when he became employed by the Missouri Pacific as inspector, with headquarters at St. Louis. Remaining in this position for about six months he was appointed signal supervisor of terminals on the Missouri Pacific at St. Louis, Mo. He held this position until about April 5, 1906, and a few days later took charge of a construction gang, installing automatic block signals in Louisiana and Texas on the Southern Pacific. Continuing in this work until the middle of October, 1907, he entered the service of the C., R. I. & P. as foreman of construction in Kansas, and on April 1, 1908, was appointed signal supervisor for the Illinois division. On June 15, 1909, he was appointed signal supervisor of the Choctaw District.

W. H. Higgins, supervisor of signals for the Central Railroad of New Jersey, in charge of the signal department, began his railroad career with the Pennsylvania in 1875, as brakeman on the wrecking train. He served in this capacity for four years. Then, for eight years, he was a member of the construction forces of the Telegraph department. Being promoted to the position of electrician at Jersey City, he remained until 1890, when he was transferred to the signal department. Mr. Higgins was appointed general foreman for the Pennsylvania later, and was put in charge of all the construction and maintenance forces on the interlocking and block signal work between Jersey City and Newark. He continued in the service of the Pennsylvania until July 1, 1901, when he accepted the position of supervisor of signals for the Central Railroad of New Jersey, which position he now holds.

Edwin C. Hitchcock, inspector, signal department, N. Y., N. H. & H., was born in Boston, Mass., in 1872, and his early education was received in the public and high schools of Lowell, Mass. He began his railroad career in the train service of the N. Y., N. H. & H. in June, 1896. In October, 1901, he entered the signal department as draftsman, and was appointed chief draftsman in June, 1905. He was promoted to inspector at New Haven, Conn., in July, 1908, which position he now holds.

Mark H. Hovey, safety service expert for the Wisconsin Tax and Railroad Commission, graduated from E. M. C. S., Bucksport, Me., in 1896, and began signal work with the National Switch & Signal Co. at Chicago in August, 1897, serving that company as helper and electrician until June, 1899, and leaving its service to go to the Hall Signal Co. With that company he was engaged as electrician and foreman until July, 1900. He then entered the service of the Taylor Signal Co. as foreman, and in this position had charge of a number of the first electric interlocking plants in this country. He remained with the Taylor Co. until August, 1903, leaving it to become signal foreman of the Houston & Texas Central at Houston, Texas, having charge of maintenance and operation of all signals on the line, together with the construction of all new work. Remaining with the H. & T. C. R. R. until June, 1905, he accepted a position with the General Railway Signal Co. at Buffalo, N. Y., in the estimating department. In January, 1906, he was given the position of chief assistant to the engineer of sales and installations, having charge of estimating, locking and circuit work in connection with mechanical interlocking, electric interlocking, and block signals. In September of the same year he was appointed signal engineer of the Illinois Central. In September, 1908, he left the I. C. and entered the service of the Block Signal & Train Control Board of the Interstate Commerce Commission. A year later he became superintendent of construction of the American Railway Signal Co. at Cleveland, Ohio. On January 1, 1910, he was called to Madison, Wis., to serve the Wisconsin Tax and Railroad Commission in connection with signaling and interlocking. At the same time he resumed his work with the Block Signal & Train Control Board, and is now in charge of all safety matters in connection with steam and electric roads with the title of safety service expert.

G. W. Hulsizer, signal engineer of the Chicago & Alton Railroad Company, Bloomington, Ill., began his railroad career with the Lehigh Valley in 1893 with a locating party of the engineering department. Shortly afterwards he learned telegraphy and entered the employ of the C. & A., where he remained until 1900 as a telegraph operator and agent. Becoming interested in automatic block signaling, he began working in a signal construction gang for the Lehigh Valley, and after a few months of construction work decided to take his turn at maintenance and was soon doing relief maintenance work. In October, 1901, he was made assistant foreman of construction, in which position he remained until the following summer, when he secured a position as repairman on pneumatic work with the Chicago & Northwestern, working out of Wells Street Station, Chicago. After two and one-half years of maintenance he was appointed signal super-

visor of the Western district at Boone, Iowa. This position he held until September, 1907, when he went to the Southern, at Washington, D. C., as assistant to the electrical and signal engineer. He remained there until November 1, 1909, when he was appointed signal engineer of the Chicago & Alton, at Bloomington, Ill.

Robert C. Johnson, assistant signal engineer of the Electric Zone, N. Y. C. & H. R., was born in Pittsburg, Pa., in 1877. After a public school education, he took a mechanical engineering course in the University of Pittsburg, graduating in 1899. He then entered the employ of the Union Switch & Signal Co. as draftsman in the Swissvale office and remained there until 1902, when he was transferred to the New York office, where he was employed in various capacities until 1905. In this year he entered the service of th Tidewater Railway (now the Virginian Railway) as signal engineer, with headquarters in Norfolk. In 1906 he left the Tidewater to go with the New York Central on the Electric Zone in New York, and in 1907 was made assistant signal engineer.

Tom L. Johnson, supervisor of signals, D., L. & W., was born in York, capital of Yorkshire, England, in August, 1874. He emigrated to the United States in June, 1888, and worked at different occupations in Trenton, N. J., such as lamp making, buffing, brass spinning, moulding, and machinist work up to January, 1892, at which time he commenced his career in the signal profession. He has worked up from the bottom of the ladder to supervisor, having been helper, ass't fitter, fitter, ass't foreman and foreman in the mechanical line and as helper, ass't wireman, wireman, ass't foreman, maintainer, foreman, general foreman and supervisor in the electrical line.

Joshua C. Jones, supervisor of signals, Lehigh Valley, was born at Catasauqua, Lehigh County, Pa., on November 27, 1871. His early education was obtained in the public schools. He was engaged as a mechanic in a rolling mill, and as a student of architecture. In 1895 he took up the installation of electric generating plants, telephones and other electrical apparatus. On March 18, 1896, he entered the service of the Lehigh Valley as batteryman and maintainer, and on July 1, 1899, was promoted to the position of division signal inspector. On January 1, 1903 he was advanced to the position of supervisor of signals.

Arthur J. Kelly, supervisor of signals of the Chicago division of the C., C., C. & St. L. at Indianapolis, Ind., was born April 3, 1877, at Howewood, Ill. After completing the public school course he went into the grocery and meat business until sixteen years of age. He was then employed by the Union Switch & Signal Co., installing interlocking plants. After a few years he was made assistant foreman and in 1893 he was employed by the Pneumatic Signal Co., only installing two plants for that company, when he was appointed to his present position in 1904.

L. E. Kinch, supervisor of signals of the Pennsylvania, was born November 1, 1857, at Franklinsville, Pa. He completed his early education in the public schools of Altoona, Pa., and was machinist's apprentice in the Altoona shops. He later was employed in the Altoona shops, and was put on special duty in charge of the track indicators and dynamometers and other special work. In 1891 he was transferred to the Pittsburg division of the Pennsylvania, as supervisor of signals. In 1907 he was transferred to the position of supervisor of signals for the Monongahela.

Herman T. Kramer, signal engineer of the Detroit United Railways, Detroit, Mich., was born in Detroit, November 18, 1881. After completing the public school courses he spent two years sailing the Great Lakes, and then entered the civil engineering course at Michigan Agricultural College. Graduating as a civil engineer, he was employed by the Detroit United Railways, and was for three years transitman and draftsman. On August 1, 1908, Mr. Kramer was appointed signal engineer of the Detroit United Railways, the Detroit, Jackson & Chicago Railway, the Rapid Railway Co., and the Detroit, Monroe & Toledo Short Line Railway, which position he now holds.

Harry W. Lewis was born April 4, 1868, at Gwynedd, Montgomery Co., Pa. He was educated at the public schools and took two years' special business course at the North Wales Academy and School of Business. During vacations he worked at the carpenter trade and learned telegraphy. He entered the service of the Philadelphia & Reading in March, 1884, filling the following positions: Assistant signalman, extra telegraph operator, signalman and station agent, until January, 1894. He was special agent for the New York Life Insurance Co. from January, 1894, to August, 1894. He entered the service of the Lehigh Valley August 13, 1894, as relief telegraph operator, was promoted to the position of signal inspector, May, 1895, made division signal inspector, August, 1900, promoted to supervisor of signals, March 1, 1902; promoted to signal engineer October 15, 1906.

Arthur J. Loughren, signal supervisor of the New York Central & Hudson River, was born at Hyde Park, N. Y., August 11, 1873. He was educated in the Hyde Park public schools and Eastman's College, Poughkeepsie, N. Y. He entered signal work in May, 1893, on the Mohawk division of the N. Y. C. & H. R., and from then until 1903 was consecutively batteryman, maintainer and foreman on the Mohawk, Western, and Hudson divisions of that road. In 1903 he was appointed assistant signal supervisor for the Hudson division and on July 1, 1906, was promoted to the position of signal supervisor of the Harlem division. A year later he was made signal supervisor of the Suburban district, Hudson division. July 15, 1908, he was appointed signal supervisor of the Western division.

Theodore E. Lutz was born in Schuylkill County, Pa., April 6, 1872. He attended the common schools of that county while learning the blacksmith's trade, and at the age of nineteen he moved to Ohio. After working at his trade in various places for about a year, he entered the service of the Big Four, as a blacksmith in the interlocking gang, under Mr. C. A. Christofferson, now signal engineer of the Northern Pacific. After serving in various capacities in the signal department, in 1895 he was appointed signal supervisor of the Cleveland-Indianapolis division at Galion, which position he now holds. Mr. Lutz is well known as an inventor of interlocking apparatus. Among the most noted of his inventions are the "Lutz Adjuster," and the adjustable crank attachment. The former is made in six different styles, designed for pipe lines operating signals, locks and detector bars, switches and derails. The adjuster performs two functions, that of a turnbuckle and that of a switch adjustment. The adjustable crank attachment is a very simple device, doing practically the same work as the apparatus first mentioned. A cut and description of this device will be found elsewhere in this issue. Mr. Lutz is the original inventor and joint patentee of the "Hayes Derail," but disposed of his interest to the Hayes Track Appliance Co. Mr. Lutz is a member of the Railway Signal Association, Signal Appliance Association, and is the manufacturer of his late inventions.

J. R. Lyons, signal supervisor for the Chicago & Alton, entered the signal department of the Queen & Crescent in April, 1892. He was with this company until September, 1899, when he accepted a position as signal supervisor for the C. & A. Mr. Lyons installed the first signal on the C. & A.

G. N. MacDougald, signal engineer of the Virginian Ry. had charge of the engineering and installation on that road of the telephone train dispatching system, which now covers the line between Roanoke, Va., and Deepwater, W. Va., and

will soon be extended to include the whole road. Mr. MacDougald is also in charge of the maintenance of both the telephone and telegraph systems. Mr. MacDougald was supervisor of signals on the Long Island for thirteen years. Later he became signal engineer with the Chicago & Alton, which position he left to take up his present work with the Virginian Railway four years ago. He has installed all the automatic block signals and a number of interlocking plants on this road, and he also has charge of all the electrical equipment on the road with the exception of power plants covering draw-bridges and storage batteries for signals and the Pullman service.

George E. MacFarland, supervisor of signals of the Pennsylvania, was born at Apollo, Pa., Nov. 11, 1874. Completing the public school course, he entered the service of the Pennsylvania as telegraph operator in 1892. Two years later he became a member of the signal department as signal repairman on the Philadelphia Terminal division, and, later, interlocking repairman. Between February, 1899, and February, 1903, he studied electrical engineering at Drexel Institute, Philadelphia. March 1, 1904, he was made assistant signal foreman on the Monongahela division of the Pennsylvania, and two years later was appointed foreman of automatic block signals on the Central division. His appointment as assistant supervisor of signals on the Allegheny division came Sept. 30, 1906, and on May 16, 1907, he was transferred to the Middle division. On Feb. 1, 1909, he was appointed supervisor of signals on the Buffalo division.

A. H. McKeen, signal engineer of the Oregon Railroad & Navigation Co., began signal work in April, 1895, as signalman for the Southern Pacific at Oakland, Cal. In November, 1900, he became signal supervisor of the Sacramento division with headquarters at Sacramento, and continued in this position until March, 1903, when he was appointed signal supervisor for the coast division at San Francisco. In May, 1905, he was made assistant signal engineer for the Oregon Railroad & Navigation Co. and the Southern Pacific Lines in Oregon, with headquarters at Portland. Two years later he was appointed signal engineer of the same roads.

Samuel Mallet, signal supervisor of the New York Central & Hudson River, was born in Huntingdon, England, on January 1, 1870, and came to the United States in 1895. His first railroad experience was with the N. Y., C. & H. R. as extra signal man from 1895 to 1897. This was followed by a period of service as maintainer's helper during 1897 and a portion of 1908. In the latter year he was promoted to the position of maintainer and continued as such until the latter part of 1899, when he was appointed construction foreman. Remaining in this positon until 1907, he was then transferred to the Pennsylvania division of the New York Central as signal supervisor, which position he now holds.

William N. Manuel, supervisor of signals of the Grand Rapids & Indiana, at Grand Rapids, Mich., was born at Kokomo, Ind., November 24, 1876. His early education was received in the public schools of Richmond, Ind. In 1894 he entered the service of the Pittsburg, Cincinnati, Chicago & St. Louis as a section laborer at Richmond, Ind. Learning telegraphy, he was telegraph operator from 1895 to 1897. In that year he became signal repairman, and three years later, assistant foreman of electric signals for the Pittsburg division. The following year he spent in the construction department of the Taylor Signal Co., and in 1903 he was appointed foreman of electric signals, Pittsburg division, Pennsylvania Lines, west of Pittsburg. In 1905 he was made supervisor of signals for the Grand Rapids & Indiana.

Sam Miskelly, general signal inspector of the Rock Island, was born in the northern part of Ireland, May 12, 1876. He was 5 years of age when his parents came to this country. Following the completion of the public school course in the Chicago schools he worked five years as a carpenter in that city and in November, 1899, entered the service of the Union Switch & Signal Co. as carpenter, building towers. While in their employ he worked as mechanical interlocking fitter and mechanical interlocking foreman for a short time. He was also engaged on the installation of Union electro-pneumatic interlocking machines and automatic block signals. In July, 1903, he left the Union Switch & Signal Co. and became signal maintainer for the Chicago & Northwestern, where he remained until November, 1904. He was then appointed signal construction foreman on the Rock Island. Remaining in this position until December, 1906, he was appointed signal inspector with headquarters at Cedar Rapids, Iowa, and was later transferred to Des Moines. On June 15, 1909, he was appointed signal supervisor of the Illinois division with headquarters at Rock Island. He remained in this position until February 1, 1910, when he was appointed general signal inspector for the Rock Island Lines, with headquarters at Chicago.

William Morrison, assistant signal engineer, Electric Zone, New York Central, started signal work with the Union Switch & Signal Co. in 1892, installing lock and block on the N. Y., C. & H. R., continuing in their employ for three years. He then entered the service of the Boston & Maine at the North Union station and remained there for six years as a maintainer. He then returned to the Union Switch & Signal Co. as foreman and remained with them on construction work for three years, after which he went with the Interborough Rapid Transit Co., of New York, as assistant signal engineer in charge of maintenance and construction. Two years later he went with the New York Central & Hudson River on the Electric division as assistant signal engineer in charge of construction work.

G. A. Motry, signal supervisor of the Baltimore & Ohio, was born February 25, 1876, at Sandusky, Ohio. At the age of 17 he began an apprenticeship in the factory of the Western Electric Co., at Chicago, working in various electrical departments for about two years. For several years thereafter he was employed on electrical work by the Chicago Edison Co., the Goodrich Transportation Co. and other firms. In December, 1900, he entered railway service as bell repairman for the Baltimore & Ohio Southwestern, remaining on this work until May, 1901, when owing to poor health he was forced to give it up temporarily. After several months he accepted a position as clerk and remained in this capacity until April, 1905, when he returned to the B. & O. as signal repairman on the Pittsburg division, and in December of the same year he was promoted to the position of signal foreman for the Pittsburg district. On September 1, 1909, he was appointed signal supervisor for the Pittsburg division, which position he now holds.

A. Munthe was born in Norway in 1870. After graduation from the Christiana Cathedral School, a government institution, he studied chemistry and other scientific subjects under private instruction for a few years. In 1890 came to Canada and entered the service of the Canadian Pacific engineering department. He left that road in 1895 and accepted a position with the R. G. Peters Salt & Lumber Co., which owned and operated the Manistee & Luther Ry. In 1896 he resigned on account of illness and engaged in business. In 1899 he accepted a position in the engineering department of the Chicago, Great Western and in 1901 was transferred to the signal department of the same road as chief clerk. He resigned in 1905 to become signal inspector and acting signal engineer of the Northern Pacific, remaining in this capacity until February, 1909, when the signal department of this road was formally organized under Mr. Christofferson. Since that time he has been assistant engineer in charge of the office.

J. Parker, signal sugervisor for the New York Central &

Hudson River, was born March 10, 1870. He entered the service of the New York Central September 1, 1900, as lampman. In the following year he was appointed maintainer and two years later was made inspector. Since then he has filled consecutively the positions of foreman of electric interlocking, district foreman, assistant supervisor, and supervisor. He was appointed to his present position in 1907.

L. V. Parle, signal supervisor of the Los Angeles division of the Southern Pacific, entered the service of that road in July, 1899, as signalman in a small branch tower and remained in this position one year. He was then made relieve signalman, handling in turn all the towers in southern California. In September, 1902, he was made interlocking construction foreman and installed and rebuilt several towers. In April, 1904, he went to Sacramento division and worked on the installation of automatic block signals between Truckee and Sparks. He returned to the Los Angeles division in October of the same year and worked as interlocking repairman until June, 1905, and was then made construction foreman on automatic block signals.

F. P. Patenall, who for twenty-two years has been signal engineer of the Baltimore & Ohio, started his railroad career as a clerk in the signal department of the Lancashire & Yorkshire Ry., Manchester, England. He was educated at the local grammar school in his home town, Higham Ferrers, Northamptonshire, England, and commenced railroad work at the age of seventeen.

After two years service with the Lancashire & Yorkshire, he entered the employ of Stevens & Sons, signal contractors of London, as helper, shortly afterwards becoming fitter, and was engaged on signal construction work on the London & South Western and Metropolitan District Railways, covering a period of two years.

Coming to this country in 1885 he entered the service of the Union Switch & Signal Co., and after three years at construction work for that company, was appointed superintendent of signals, B. & O., this title being changed later to that of signal engineer.

He has always been a staunch advocate of three position signaling, believing that the indications displayed under that system safely and satisfactorily fulfill all the requirements; in fact, the B. & O. has been operated under such a system since 1888. In 1894 he made recommendations concerning the adoption of the green and yellow lights for clear and caution, respectively, which practice has since been made standard on many railroads. Believing that the upper quadrant method of signaling was nearer perfection and provided means of obtaining greater safety in railroad operation than any other, on his recommendation the B. & O. adopted its use as standard in 1906, and all the construction work has been installed accordingly since then. He is an active member of the Railway Signal association, and the American Engineering and Maintenance of Way association, being a member of Committee No. 1 in the former, and of No. 10 in the latter.

Charles S. Pflasterer, assistant signal engineer of the Oregon Short Line, was born in Pittsburg, Pa., August 31, 1873. He attended the public schools of Braddock, Pa., and the State Normal School at California, Pa. On August 3, 1891, he was employed by the Union Switch & Signal Co., and after two years was transferred to the shops at Swissvale, where he remained for a short time. He was successively thereafter in the service of the Johnson Railroad Signal Co., the National Railroad Signal Co., the Chicago & Eastern Illinois, and the Lake Street Elevated, Chicago, as interlocking fitter and inspector until 1895. Between that time and 1899 he was engaged in interlocking work for the Cleveland, Cincinnati, Chicago & St. Louis, being interlocking inspector during the latter part of his service for this road. He next went to the Chicago Great Western, and for the two years following was his assistant and foreman. In 1901 he went to the Union Pacific as interlocking foreman and inspector. Two years later he became construction foreman for the Union Switch & Signal Co., working out of the New York office, and continued in this capacity until January, 1904, when he entered the service of the General Railway Signal Co. On August 1, 1904, he returned to the Union Pacific as interlocking foreman, and was rapidly promoted successively to the positions of general interlocking foreman, general signal foreman, and general signal inspector. The McClintock Manufacturing Company secured his services in December, 1907, and he remained with that company for a time. Later he was engaged in signal work for the Chicago, Rock Island & Pacific, and then as assistant signal supervisor for the C., C., C. & St. L., at Galion, O. He then went to the Wheeling & Lake Erie, serving in various capacities until September 1, 1909, when he was appointed assistant signal engineer of the Oregon Short Line.

G. S. Pflasterer was born May 22, 1869, near Allegheny City, Pa. When four years old his parents moved to a small town, California, Pa., where they lived for a number of years, and there he received a common school education. Later they moved to Braddock, Pa., where he started in as a laborer in one of the construction gangs of the Union Switch & Signal Co., in the summer of 1889, at the age of 19. He stayed with the Union Switch & Signal Co. for three years, being advanced from time to time, and then resigned to accept a position as construction foreman for the Johnson R. R. Signal Co. He remained with them for about a year and then left to accept a position with the C. & E. I. as supervisor of signals, and held this position for eleven years, resigning to accept the position of signal inspector for the N. C. & St. L., which position he has held for the past seven years, until his promotion to signal engineer, October 1, 1910.

J. D. Phillips, signal supervisor of the Philadelphia & Reading, was born near Pottsville, Schuylkill County, Pa., November 14, 1863. He was educated in the public schools of Ashland and Frackville, and at the age of 11 entered the anthracite coal mines. After twelve years of service in the mines, in September, 1886, he became telegraph operator for the Philadelphia & Reading at Mahanoy City, Pa. Two years later he was made signalman at an interlocking tower, where he remained until July, 1899, doing local electrical work during his spare time. In 1897 he took up a course in electrical engineering and completed it three years later. In 1900 he was with the Hall Signal Co. for a short period during installation of the signals on the P. & R. He then returned to the services of the railway company and in 1902 was made supervisor of signals of the Reading division.

Robt. M. Phinney, assistant engineer of the signal department of the Chicago & Northwestern, was born at Barnstable, Mass. He graduated in 1904 from the Massachusetts Institute of Technology, in electrical engineering. From this time until October, 1906, he was employed on electrical construction work by the Swan Electric Co. of Boston. During 1906 he entered the service of the Northwestern Construction Co. at Boone, Iowa, as a draftsman, this company being engaged in the electrification of a steam railroad. In April, 1907, he became employed by the Illinois Central as draftsman in the signal department, at Chicago. In August, 1908, he entered the service of the Northwestern as draftsman in the signal department, being later appointed to the position of chief draftsman. On March 8, 1910, he was made assistant engineer of the signal department.

E. K. Post, supervisor of signals of the Philadelphia, Baltimore & Washington (Pennsylvania), has been engaged in signal work for the last twelve years, during which time he has been connected with the New York, New Haven & Hartford, the Union Switch & Signal, the Delaware, Lackawanna

& Western and the Pennsylvania, having served consecutively as batteryman, maintainer, construction foreman, circuit draftsman, assistant supervisor of signals, and supervisor of signals of the Central division of the P., B. & W.

W. M. Post, supervisor of signals of the Pennsylvania, was born in Andover, Conn. He entered the signal department of the New York, New Haven & Hartford in May, 1896, as batteryman on the Hartford division, serving in this capacity and in the repair gang and also as repairman until May, 1900, when he was appointed signal foreman in charge of maintenance and construction on the Hartford and Highland division. In June, 1905, he entered the service of the Pennsylvania as circuit draftsman in the signal engineer's office. He was later appointed assistant supervisor of signals on the West Jersey & Seashore and served in this capacity during the construction of the alternating current track circuits on the electric lines between Camden and Atlantic City. In December, 1905, he was transferred to the Pittsburg division as assistant supervisor of signals. He was appointed supervisor of signals of the Chautauqua division in February, 1909, and, in June of the same year, was transferred to the signal engineer's office. He was appointed supervisor of signals of the New York division on July 1, 1909.

E. B. Pry, signal inspector of the Pennsylvania Lines West of Pittsburg, entered the service of the P. C. C. & St. L. in 1894 as signal inspector. In 1903, he was transferred to the Grand Rapids & Indiana as signal supervisor with headquarters at Grand Rapids, Mich. Two years later, in 1905, he was transferred to the Pennsylvania Lines West as signal inspector in the signal engineer's office, with headquarters at Pittsburg.

J. W. Raviler, supervisor of signals of the Philadelphia & Reading, was born at Cleveland, Ohio, October 7, 1866. His railroad career began in 1890, when he became a telegraph lineman for the Michigan Central. In 1892 he was employed by the Hall Signal Co. as line foreman on the Galena, Milwaukee and Wisconsin divisions of the Chicago & Northwestern. In 1894 he was transferred to Albany on the Delaware & Hudson. During the same year he assisted in the construction of automatic signals on the Philadelphia & Reading at Philadelphia and worked as signal maintainer for the Hall Signal Co. at Newark, N. J., on the D., L. & W. In January, 1895, he entered the signal department of the New York, New Haven & Hartford at Hartford, Conn. Remaining in this position but a short time he became signal maintainer for the P. & R. at Wayne Junction, Philadelphia. In 1900 he was appointed chief signal inspector of all signals on the P. & R. His appointment to his present position as supervisor of signals on the Harrisburg division of the Philadelphia & Reading was made in 1905.

E. J. Relph, signal inspector of the Northern Pacific at St. Paul, Minn., began signal work with the Union Switch & Signal Co. in July, 1888. Later became associated with the National Switch & Signal Co. On March 1, 1898, he accepted a position in the signal department of the Rock Island, where he was engaged in the construction and maintenance of signals until September, 1909, being successively, supervisor, inspector and interlocking engineer. He then took up construction work in the signal department of the Chicago, Burlington & Quincy, and later became superintendent for the C. F. Massey Co. at Chicago. He resigned this position on May 12, on which date his appointment on the Northern Pacific became effective.

D. S. Rice, supervisor of signals of the Lehigh Valley, entered the service of this road as lamp man in June, 1891. Learning telegraphy he was later employed as a telegraph operator at various stations on the Lehigh between the years of 1893 and 1901. During the latter year he was transferred to the signal department where he worked as a repairman and division foreman until October 15, 1906, when he was appointed assistant to the supervisor of signals on the Lehigh and New Jersey division. His appointment to his present position as signal supervisor was made on January 23, 1907.

Burton Henry Richards was born at Dorset, Ashtabula county, Ohio, July 18, 1887. At the age of 16, from the force of circumstances, he was compelled to shift for himself. His schooling was such as was furnished by the common school system then existing in his native state. In the '90's he was employed by the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., which extended from Geneva to Seneca Falls, a distance of sixteen miles. He served this company for six years in the position of foreman of the car barns and in other work. In 1902 he was employed by the Hall Signal Co., remaining with them for a short time. He then became signal maintainer for the Lehigh Valley. Two years later he returned to the Hall Signal, on construction work for the Central Railroad of New Jersey, and later became a maintainer and remained with the C. of N. J. R. R. for a year in this capacity. The Hall Signal Co., then employed him as construction foreman. He was in charge of the equipping of the Delaware & Hudson with automatic block signals from Binghamton to Nineveh, from Nineveh to Albany and Schenectady, from Saratoga to Lake George, and from Ft. Edward to Westport. He then went with the D. & H. for a year as signal inspector on the Susquehanna division. In December, 1908, he became lamp inspector for the Rock Island, with headquarters at Chicago, and subsequently, on October 15, 1909, was appointed superintendent of signal construction for the Rock Island.

A. H. Rudd, born March 8th, 1867, at Lakeville, Conn.; and graduated from the Sheffield Scientific School, Yale University, in 1886 and entered the service of the Pennsylvania Railroad Company as a draughtman in the real estate department, November 1st, 1886. Transferred to the signal department, March 1st, 1888, and worked there as a draughtman until February 29th, 1892. He left the service of the P. R. R. to go with the New York Central as inspector of signals, March 1st, 1892 and held this position until May 1st, 1892, when made signal engineer, installing block and interlocking signals on the New York Central until May 1st, 1893, when he was promoted to assistant superintendent of signals. He was in charge of all maintenance and construction, Mott Haven to Albany. He left the service of the New York Central and entered the service of the New York, New Haven & Hartford as foreman of electric signals, Hartford division, August 15th, 1894. Afterwards he was promoted to signal engineer of the Hartford and Valley division, same road, in charge of all maintenance and construction of signals and also of electric lighting of station, etc., at Hartford, until April 1st, 1900. April 1st, 1900, until March 1st, 1903, he was signal engineer, D. L. & W.. He returned to the Pennsylvania as assistant signal engineer, March 1st, 1903, and was promoted to signal engineer August 1st, 1907.

Junior Vice-President Railway Signal Association, 1906; Senior Vice-President, 1907; and President in 1908; member Executive committee, Railway Signal Association from 1906 until the present time. Director of the American Railway Engineering & Maintenance of Way association, chairman of Committee No. 1, on signaling practice, Railway Signal association; chairman of Committee No. 10, on Signals and Interlocking, American Railway Engineering & Maintenance of Way association; Honorary Member Institution of Signaling Engineers of Great Britain.

P. Schultz was born in Denmark, March 9, 1870. He served five years as an apprentice in the cabinet trade, commencing at the age of 14. He attended the technical school for the five seasons of his apprenticeship, and then came to the United

States in 1891. He took up the building trade in Portland, Ore., but owing to dull times had to give it up and entered the service of the Southern Pacific in a bridge gang in July, 1895. He became signal foreman in 1899 and signal supervisor in 1907.

H. O. Seifert, general foreman of signals of the Chicago Terminal Transfer Railroad, was born in Germany, July 25, 1876, and came to America in 1888. His railroad service dates from 1891, when he started in signal work on the Pennsylvania. Between this time and 1897 he worked for railroad and signal companies on maintenance and construction work, and in 1898 took charge of a signal repair gang on the E., J. & E. A year later he was in charge of a gang on the Chicago division of the Pennsylvania. In June, 1901, he was appointed signal supervisor on the C., A. & C. division of this road, but was compelled to withdraw from active work on account of poor health, and resigned in May, 1902. Returning to signal work later, he became signal inspector on the Chicago division of the Pennsylvania. In 1903 he accepted a position with the Pneumatic Signal Co. and was shortly thereafter appointed foreman. In February, 1904, he resigned and in the following month entered the service of the Chicago Terminal Transfer Railroad in the bridge and building department. In June of the same year he was appointed general foreman of signals.

Ainsworth W. Seymour, signal supervisor for the Harlem and Putnam divisions of the New York Central & Hudson River, was born in Cazenovia, Madison County, N. Y., on September 1, 1874. His education was obtained in the public schools of Troy and at Lansingburgh Academy, Lansingburgh, N. Y. Completing a teacher's training course at this academy at the age of 16, he took u pteaching and for a number of years taught at Canastota and other places in New York state. In 1894 he entered the service of the New York Central & Hudson River, in the signal department on the Mohawk division. In 1902 he was transferred to the Pennsylvania division of the same road, and in 1905 was again transferred, this time to the Hudson division where he was appointed signal inspector and was given charge of maintenance and construction work between Poughkeepsie and Albany. He was made assistant signal supervisor in 1907, and served in this capacity until June 1, 1910, when he was appointed supervisor of the Harlem and Putnam divisions.

G. R. Scattergood, circuit engineer, P. R. R., at Philadelphia, was graduated from the Central Manual Training School in 1900 and then became draftsman for the Electric Storage Battery Co., where he remained until 1905. In that year he was given a position as mechanical draftsman in the signal department of the P. R. R. and held this position about a year. He then became a circuit draftsman, which position he held until the first of this year, when he was made circuit engineer.

A. G. Shaver, Signal Engineer, Rock Island Lines, at Chicago, Ill., graduated from Rose Polytechnic Institute in 1897. In 1898 he entered the service of the Chicago & Eastern Illinois as signal maintainer and batteryman. In addition to taking care of the signals in his territory he also had charge of the electric lighting facilities, etc. On April 1, 1901, he was appointed assistant engineer of the Union Pacific, in charge of the signal department, and on November 1st of the same year he was appointed signal engineer. He remained in this position until April 3, 1906, at which time he accepted a position with the Hall Signal Co., at Garwood, N. J., as signal engineer. He was with the Hall Signal Co. two years and in June, 1908, was appointed signal engineer of the Rock Island Lines, with headquarters in Chicago.

Edward James Sheeren, signal supervisor of the Missouri Pacific at Chester, Ill., was born in Kingsville, Mo., March 29, 1882. He entered railroad service on the Missouri Pacific at Kansas City, September 1, 1906, as storekeeper's clerk, where he remained until June, 1907. Entering the signal department of the St. Louis, Iron Mountain & Southern, as maintainer of signals, he occupied this position until January of the following year, when he was made signal foreman. December 1, 1908, he was appointed signal supervisor for the Missouri Pacific with headquarters at Chester, Ill.

W. W. Slater, signal engineer of the Southern Pacific at San Francisco, began his railroad career in 1862 as train boy on a railroad in Ohio, which at that time had no telegraph line. The trains were operated only by printed rules. During the years he was thus engaged he worked during the summer and attended school in the winter. A telegraph system was established on his road in 1864, and he went into the telegraph office in Columbus, Ohio, as a messenger boy. Learning telegraphy in the fall of the same year he was put in charge of an office in Indiana. Continuing in this line of work, he was employed at various places in Ohio, Indiana and Illinois, until 1869, in which year he went to California and there assumed charge of an office at Niles. In 1875 he was promoted to the position of train dispatcher, being at Oakland Pier. In 1885 the Union Switch & Signal Co. installed three electro-pneumatic interlocking plants at Oakland Mole Terminal, and at two crossings in Oakland. Mr. Slater took a keen interest in this work. This brought him to the attention of the operating officials, and upon the completion of the system he was selected to take charge of it with title of "master of signals." In 1898 he was given the title of signal engineer, and his headquarters were removed from Oakland to the general offices of the company in San Francisco.

Hal Smith, supervisor of signals of the Union Pacific, entered the service of that road in November, 1903, at the age of 21 as repairman on the electric interlocking plants at Omaha, Neb. In January of the following year he was made signal repairman, and a year later signal foreman in charge of these plants. In August, 1906, he was appointed supervisor of signals of the Kansas division with headquarters at Kansas City.

Milton E. Smith, signal engineer of the Delaware, Lackawanna & Western, was born at Greensboro, Md., August 25, 1865. His education was obtained at the Castle Hall School at Gouldsboro Md. In 1881 he took up telegraphy as a profession and entered the service of the Philadelphia, Wilmington & Baltimore (now the Philadelphia, Baltimore & Washington) being stationed at the interlocking tower at West Yards, on the outskirts of Wilmington, Del. Remaining in this position until 1883, he then became a telegraph operator for the Erie, at Saddle River, N. J. Later he was promoted to the position of signal inspector. In 1893, be became maintainer on the New York Central & Hudson River, Western division. Early in 1900 he gave up this position to enter the signal department of the Delaware, Lackawanna & Western, as wireman in the constructing gang. In the latter part of the same year he was promoted to the position of construction foreman. On January 1, 1903, he was appointed supervisor of signals on the Scranton division; and on March 16, of the same year he was made signal engineer, which position he now holds.

Wilford L. Smith, supervisor of signals of the Maryland division of the Philadelphia, Baltimore & Washington, Pennsylvania Lines, was born in Wilmington, Del., October 2, 1864. He entered service of P. B. & W. July 6, 1880, as carpenter apprentice, under the supervision of the master carpenter and bridge builder, who also had charge of what signals there were at that time on the Maryland division, these being for the most part of the old banner type. On October 31, 1888, he was made foreman of signals, and on June 1 of the following year was appointed supervisor of signals for the Maryland division of the P. B. & W., his present position.

W. N. Spangler, supervisor of signals of the Pennsylvania

Tunnel and Terminal, was born at Jennerstown, Summerset County, Pennsylvania, August 6, 1877. He was educated at the common schools and the Central State Normal school of Lock Haven, Pa. During two terms following his junior year at the Normal School he taught at the Embich School, near Carrolltown, Pa., and during the term just following his completion of the school year in the same institution he was principal of the Lamar Township School at Salona, Pa. During the summer of 1899 he went to Philadelphia with the intention of entering an institution for the study of medicine, but on account of sickness was prevented. In the latter part of this year he was employed by the Pressed Steel Car Co. of McKees Rocks, Pa., as steel yard and erection chief inspector. About a year later while on a visit to Altoona he became interested in the electro-pneumatic control of the switches at one of the Pennsylvania freight classification yards, and applied for a position on this work. Shortly afterward he entered the railway service as a laborer in a signal gang, and on January 1, 1901, was made repairman. His appointment as foreman of signals at Altoona came on December 1, 1902, and on November 25, 1905, he was made assistant supervisor of signals on the Middle division of the Pennsylvania. On February 1, 1906, he was transferred to the West Jersey & Seashore as supervisor of signals. On January 15, 1908, he was transferred to New York as supervisor of signals of the Pennsylvania Tunnel & Terminal.

C. H. Spencer, engineer of the Washington Terminal Co., was born May 7, 1867, at Detroit, Mich. He graduated from the engineering department of the University of Michigan in 1896, and soon afterward entered the engineering department of the Lake Shore & Michigan Southern as a rodman. Remaining two years as rodman and transitman he severed his connection in 1898 to enter the services of the Southern Indiana as chief draftsman, and in June of the following year was made assistant engineer. One year later he became chief draftsman in the office of the engineer of construction for the Baltimore & Ohio, and continued in this position until January, 1903, when he was appointed assistant engineer in charge of construction. July 1, 1903, he became engineer in charge of construction on the Terminal lines at Washington, D. C. He continued in this position until the operation of the Terminal began, when he was appointed engineer of the Terminal.

Chas. Spikens, signal supervisor of the Interborough Rapid Transit Co. in New York, was born in England. He entered the service of the Manhattan Elevated in 1878, and assisted in installing the first interlocking plant on that road which was the third one installed in America. Later he assisted in installing all the interlocking plants on the Manhattan Elevated and has since been in charge of the interlocking and signaling on the Manhattan division, now holding the position of supervisor of signals and interlocking on this division of the Interborough Rapid Transit Co.

Chas. H. Sprinkle, supervisor of signals of the Chicago, Burlington & Quincy, began his railroad career at Canton, Mo., as baggage agent, July 7, 1879. On November 8, 1882, he was transferred to Harlem, Mo., where, as agent, he worked until 1887, when he was made chief dispatcher of the Kansas City terminals. In 1905 he was given charge of the interlocking and signal work of the St. Joseph division, in addition to his duties as chief dispatcher. In April, 1909, he was supervisor of signals of the St. Joseph division.

Miles Standish, signal supervisor of the Southern Pacific, entered the service of this road on the Coast division in San Francisco in 1899. He became sub-foreman on the installation of the first automatic electric semaphore signals put in by the road. In 1900 he was transferred to West Oakland on the Western division as signal repairman. In January of the following year he was sent to the San Joaquin division as assistant division foreman of signals. He returned to the Eastern division in June, 1903, as foreman of construction. During this period he made a trip to Nevada and installed the first automatic block signals in that state for the protection of a number of tunnels on the Central Pacific. June 1, 1905, he was made division foreman of signals, which title was later changed to supervisor of signals, and started the construction of 370 miles of continuous block signaling covering the entire main track of the famous coast line between San Francisco and Santa Barbara. He later organized the maintenance forces for this installation. May 1, 1909, he returned to the Western division as signal supervisor.

Charles Stephens, signal engineer of the Chesapeake & Ohio, was born in 1868. He entered railway service in 1892, becoming signal maintainer for the C. & O. Previous to this time he had been a blacksmith and machinist. After two years as maintainer he was made signal foreman and, five years later, supervisor of signals. In 1906 he was appointed signal engineer.

A. W. Stewart, supervisor of signals, Atlantic Coast Line, was born in May, 1874, in Canada, of Scotch parentage. He was educated in the schools of Wolfville, N. S., and started his railroad career in 1891 as clerk for J. T. Vernon, supervisor of interlocking, Old Colony railroad, now the New York, New Haven & Hartford, in Mansfield, Mass.

In 1894 he took a position in one of the gangs and between that time and 1901, in which year he left the New Haven, he was consecutively helper, fitter and maintainer on mechanical interlocking except for two years spent in Canada and a trip to the Far East. In 1901 he entered the service of the Delaware, Lackawanna & Western and for seven years was employed by that company consecutively as storekeeper, fitter, wireman, assistant foreman and construction foreman. On December 31, 1907, he left the D., L. & W. and became general signal inspector on the B. R. T. in Brooklyn.

Shortly afterward he was made supervisor of signals for the New York division of the Erie, and a short time later was appointed supervisor of signals of the Atlantic Coast Line.

E. G. Stradling was born in Indianapolis, Ind., September 5, 1880. He received his early education in the common schools of that city and entered the engineering department of the B. & O. S. W. Later he was in the engineering department of the St. Louis, Iron Mountain & Southern. In 1901 he entered Purdue University and was graduated from the school of mechanical engineering in 1905. Becoming employed by the General Railway Signal Co. he was sent to Toledo, Ohio, in connection with the installation of some electric interlocking plants at that point. From there he was sent to the Illinois Central to assist in the installing of block signals, among which were some of the first top-post mechanisms to be erected. In 1906 Mr. Stradling resigned to enter the service of the Union Pacific as signal foreman on the installation of automatic block signals. After two years with this company he resigned and accepted a position as signal inspector for the Chicago, Indianapolis & Louisville.

Charles A. Thompson, signal supervisor of the Baltimore & Ohio, at Relay Station, Md., was born June 19, 1860, at Baltimore, Md. At the age of 16 he began railway work as an apprentice in the mechanical department of the Baltimore & Ohio, at Mt. Clair, Baltimore. After completing his apprenticeship he became a machinist, and for eight years was employed in that capacity in the railway shops. In December, 1888, he entered the signal department as foreman. In 1903 he was appointed signal inspector in charge of the Baltimore and Shenandoah divisions, where he remained until 1908, when he was promoted to the position of signal supervisor in charge of the Baltimore division.

Joseph Isaac Vernon, signal supervisor, N. Y., N. H. & H.

at Boston, Mass., was born June 13, 1855, at Burbage near Buxton, Derbyshire, England. He attended public school in England until he was about 7 years of age. He entered railway service in 1876 with the Saxby & Farmer Co., London, Eng., as a signal fitter and remained with them five years. He then came to the United States and in 1881 went to work for the Union Switch & Signal Co. He left them in 1888 and entered the employ of the Old Colony R. R. on May 1st of that year as foreman of interlocking at Mansfield, Mass. In July, 1893, he was appointed supervisor of interlocking and on Aug. 1st, 1903, was appointed acting signal engineer over the entire New Haven system, which company had absorbed the O. C. R. R. In January, 1905, he was appointed signal engineer of the Eastern district of the N. Y., N. H. & H., with office in Boston.

E. L. Watson, signal supervisor of the Pennsylvania, was born in Randolph, N. H., November 23, 1875, and was educated in the public schools. In 1893 he entered the service of the Maine Central on bridge work, remaining with that company until 1897, when he took up a course in mechanical engineering at the University of Michigan. Graduating in 1901, he was again employed by the Maine Central as bridge inspector. In April, 1902, he entered the service of the Pennsylvania as draftsman in the office of the signal engineer. In 1903 he was made assistant supervisor of signals of the New York division, where he remained until April, 1905, when he was made supervisor of signals of the Baltimore division. Ten months later he was transferred to the Philadelphia division, where he remained until December, 1906, when he was assigned to special duty on the New York terminal. A year afterward he returned to the Philadelphia division.

Edwin F. Wendt, assistant engineer of the Pittsburg & Lake Erie, entered railway service in September, 1888. In that year he was graduated with high honors from Geneva College, Beaver Falls, Pa. His first position was that of chainman on the P. & L. E. He served continuously with that road until October 1, 1898, occupying consecutively the positions of chainman, rodman, levelman and transitman, and was then appointed assistant engineer, under the chief engineer in charge of maintenance of way and construction work, which position he now holds.

F. B. Wiegand, assistant signal engineer of the Lake Shore & Michigan Southern, the Lake Erie, Alliance & Wheeling, and the Dunkirk, Allegheny Valley & Pittsburg, was born in Philadelphia, March 23, 1870. He was educated in the Greenway Consolidated School of the Twenty-seventh section, first sectional district of Pennsylvania. On March 23, 1887, he entered the employ of the Union Switch & Signal Co., serving in the ranks and later as foreman. He became a maintainer for the New York Central & Hudson River in April, 1891, and served in that capacity until May 1, 1894. From then until July 1, 1906, he held positions as follows: inspector, assistant supervisor, general inspector and supervisor. On July 4, 1906, he entered the service of the Lake Shore & Michigan Southern as assistant signal engineer.

H. C. Williams was born at Sandy Creek, Oswego County, New York, on June 18th, 1867. He completed his education in the Sandy Creek High School at the age of fifteen and commenced his railroad career in the spring of 1882 as track hand on the Rome, Watertown & Ogdensburg, continuing in this capacity for a period of three years or until the spring of 1885, when he started as an apprentice to learn the blacksmith and machinist trades, at which he spent four years, completing these trades in 1889. He worked at his trade from 1889 to 1892. During eighteen months of this period he worked as a blacksmith for the West Shore in the shops at Frankfort, N. Y. He left the West Shore in April, 1892, and entered the service of the New York Central as signalman on the Mohawk division. He took up the profession of telegraphy and worked in the capacity of signalman during a period of four years until the spring of 1896, when he took up the work of signal construction as blacksmith and bench mechanic. In 1900 he was made repairman on the Mohawk division of the N. Y. C. & H. and in 1902 foreman of signals on the Pennsylvania division and a few months after was appointed general foreman of signals. In 1904 he was promoted to the position of supervisor of signals on the Harlem division.

Mr. Williams was appointed supervisor of signals on the Mohawk division in 1905, where he at once started a school for the education of the men on his division. September, 1907, this school developed into the School of Railway Signaling.

B. F. Williston, supervisor of mechanical signals of the Michigan Central at Detroit, Mich., was born at Turin, N. Y. He began work for the Michigan Central in the Bay City shops on the Saginaw division and for two years was machinist at this point. The next three years were spent as chief engineer of the Bay City waterworks. Returning then to the Michigan Central he entered the signal department as foreman. In 1886 he was appointed to the position of supervisor of mechanical interlocking.

J. R. Wills, signal supervisor of the Oregon Short Line, was born near Emerson, Iowa, May 25, 1879. He graduated from Malvern, Iowa, High School in 1898. Two years later he entered the service of the Hall Signal Co., being employed as wireman in the construction department and afterward engaged in the installation of signals. Later in the same year he entered the service of the newly-organized Taylor Signal Co. and remained with them until May, 1902, when he was made electric interlocking repairman of the Union Pacific. He left this position a little later to take a special course at the Iowa State College at Ames, Iowa, and in the summer of 1903 returned to the signal department of the Union Pacific. May 1, 1903, he resigned from his position as district foreman of the Wyoming division to go with the General Railway Signal Co. in the sales and installation departments of the Buffalo office. Returning to the West in 1907 as electric interlocking construction foreman for the Oregon Short Line he has since remained with that road. In May, 1909, he was appointed signal supervisor of the Utah division, with headquarters at Ogden. In addition to his duties as supervisor, Mr. Wills has charge of the system signal repair shop at Ogden and also has supervision over the electric train lighting inspection, together with the lighting and power for the Ogden Union Railway & Depot Co.

J. C. Young was born on March 15, 1878, at Washington, D. C., and began railroad work in January, 1897, as an apprentice in the signal department of the Southern Pacific at Los Angeles, Cal. In Decehber, 1901, he was appointed signal supervisor of the Los Angeles division and in October, 1904, was transferred to San Francisco and made assistant to the signal engineer. This position he held until April, 1906, when he left the Southern Pacific to become signal engineer of the Union Pacific, which position he now holds.

John V. Young, superintendent of signals of the Boston & Maine and the Maine Central, was educated in the public schools of Boston, Mass. He entered the service of the Union Switch & Signal Co. in 1881 as helper and clerk at Boston, and since that time was consecutively employed as draftsman, assistant superintendent, superintendent of erection and Boston agent. He was appointed superintendent of signals of the Boston & Maine in July, 1895, and in November, 1904, became superintendent of signals for the Maine Central. Since then he has filled this position for both roads.

Bridges and Building.

G. Aldrich, in September, 1881, went to work on bridges on the Eastern division of the New York & New England at Blackstone. In March, 1884, he was transferred to Fish-

kill-on-the-Hudson, N. Y., and in July, 1888, was promoted to bridge foreman on the Western division of the New York & New England, Waterbury, Conn., to Fishkill-on-the-Hudson, N. Y., headquarters at the latter place. In September, 1896, he was promoted to master bridge and building foreman of the whole New York & New England at Boston. When the New York, New Haven & Hartford absorbed the New York & New England in July, 1898, his office was abolished and the New York and New England was split up into divisions, with a bridge supervisor to each division. He was retained as inspector on new work until October, 1898, when he was appointed supervisor, bridges and buildings, on the Providence division, at Readville, Mass. In March, 1908, there was a reorganization and extension of divisions, and he was then appointed supervisor, bridges and buildings, on the Boston & Midland division, with office at the South Station, Boston, Mass.

Alexander Amos was born in Potsdam, N. Y., July 1, 1840, and worked on a farm until 19 years old. He then learned the carpenter trade, and in August, 1862, enlisted in Co. I, 142d N. Y. G V., and remained in the service until the close of the war. He then went back to his old trade as carpenter and joiner. Went to Minnesota and commenced to work for the Chicago, Milwaukee & St. Paul in the spring of 1876, as foreman carpenter on bridges. He was made chief carpenter June, 1886. He went to work for the Soo Line as superintendent of bridges and buildings. On June 1906, he was made lumber inspector at Shoreham, on account of sickness, so he could be at home. He is now 70 years old and was retired on a pension by the road on July 1, 1910.

Ralph Jesse Arey, division engineer, A. T. & S. F., at Los Angeles, Cal., was born on August 8, 1868, at Hampden, Me., and educated in the public schools of Hampden, high school and academy at Hermon, Me., Hampden Academy and the University of Maine, the degree of C. E. being conferred on June 20, 1894. He entered railway service in November, 1892, with the Atlantic & Pacific, being employed as transitman until January 31, 1893; January 1, 1894, to January 1, 1896, draftsman, Williams, Ariz.; January 1, 1896, to January 1, 1900, engineer, during reconstruction; January 1, 1900, to January 1, 1905, assistant engineer on reconstruction work; January 1, 1905, to March, 1906, resident engineer, Albuquerque and Arizona divisions; March, 1906, to January 1, 1910, division engineer, Los Angeles division; January 1, 1910, to date, engineer, Lines West of Albuquerqe.

Henry Bender started work for the C. & N. W. in the bridge and building department, September, 1897, on the Ashland division, and was made extra foreman in the summer of 1899, and foreman, 1901. In the spring of 1905 he left and accepted a positon as general foreman, bridges and buildings, with the Wisconsin Central, at Fond du Lac, Wis. He returned to the C. & N. W., June, 1909, as foreman on the Iowa division at Cedar Rapids, Ia., was made inspector of highway crossings, September, 1909, and foreman, bridges and buildings, May 1, 1910, of the Northern Iowa and Sioux City divisions at Eagle Grove, Ia.

Austin Lord Bowman, consulting engineer, department of bridges, city of New York, was born in Manchester, N. H., on the 14th of November, 1861. He graduated from Yale in 1883 with the degree of B. A. In 1885 he was in St. Paul, Minn., on city work, and later in the engineering department of the Minnesota & Northwestern, and on the Chicago, St. Paul & Kansas City on location and construction. In 1887 he was engaged on the construction of the Kings County elevated railroad in Brooklyn, N. Y. From 1887 to 1890 he was in the engineering department of the Norfolk & Western in Virginia and West Virginia on heavy construction and tunnel work. From 1890 to 1895 he was engineer and superintendent of construction for the American Bridge & Iron Co. of Roanoke, Va. During 1896 he was in the service of the United States government, and in 1897 opened an office in New York city as a consulting engineer on railroad bridge and structural work. From 1901 to 1907 he was consulting bridge engineer for the Central Railroad of New Jersey. In December, 1907, he became consulting engineer of the department of bridges of New York city. Mr. Bowman is a member of the American Railway Engineering and Maintenance of Way Association, American Railway Bridge and Building Association, American Society for Testing Materials, American Society of Mechanical Engineers, American Society of Civil Engineers, the New York Railroad Club, the Engineers' Club and other technical and professional bodies.

A. Brown was born at Lebanon, Warren county, Ohio, October 20, 1854. He entered the service of the W. St. L. & P. in August, 1886, as bridge carpenter, and worked for that road until January, 1905, when he went to the Colorado & Southern as bridge foreman, where he remained until May 1, 1901, when he went to the Colorado & Wyoming as general foreman. In May, 1906, he went to the St. Louis, Rocky Mountain & Pacific as superintendent of bridges and buildings at Raton, N. M.

M. F. Cahill was born in Lynchburg, Virginia, in 1852 and commenced bridge building in 1870 on the Chesapeake & Ohio, on the first crossing of the Green Briar river. He helped to erect a majority of the bridges on that road during construction. After completion of that work, he was with the old original American Bridge Co., otherwise known as "Old Boomer," of Chicago He did work all through the West and North-west during the period of the old Howe truss bridges. He was master carpenter for eight years on the Richmond & Alleghaney and Chesapeake & Ohio, in Virginia. He left the service of the latter in 1891 and engaged in contracting. He contracted for and built the water works of Martinsville, Virginia, and Key West, Florida, and traveled for the Virginia Bridge & Iron Co., for about a year. He became supervisor of bridges and buildings of the Pulaski division of the Norfolk & Western, and was appointed superintendent of bridges and buildings of the West Virginia & Pittsburg until the absorption of this road by the Baltimore & Ohio Ry., in 1900. He was then supervisor of bridges and buildings of the Baltimore & Ohio until the latter part of 1902, when he entered the service of the Seaboard Air Line as master carpenter, his present position.

P. W. Cahill was born in Lynchburg, Va., March 19, 1856. His earliest remembrance was of the rushing of volunteers to Manassas and the many events of the following four years, including the last cannon at Appomattox. His school days were during the years of reconstruction, when fortunes were wrecked, business deranged and so many of the southern youths deprived of an education. His was such as could be had from the old common field schools, with a short term at New London Academy. He left home in 1882 to work for the Norfolk & Western as carpenter at Norfolk and Lynchburg, Va., afterward working for the Louisville Bridge & Iron Co., the Phoenix and other iron bridge companies. At different periods he worked as house carpenter and railroad repair carpenter. His first position as bridge foreman was with the Chesapeake & Ohio, from 1888 until 1899, when he resigned to accept a similar position with the Baltimore & Ohio. He left that road in 1902 to accept a more desirable position with W. J. Oliver & Co., railroad contractors, remaining with them only a short time. He then went to the Norfolk & Western, taking charge of an iron bridge gang. He resigned in 1904 to engage in the building trade in Lynchburg, Va. After four years the financial depression of 1907 left business in all lines dull, and he accepted a position with the Seaboard Air Line as foreman in charge of their docks and terminals at Fernandina, Fla.

W. M. Cardwell was born at Danville, Va., May 26, 1872. He began railroad work on the Lynchburg & Durham in 1889.

From 1890 to 1892 he was with the bridge department of the Georgia, Carolina & Northern. From 1892 to 1899 he was engaged in highway bridge construction in Virginia and the Carolinas. He entered the service of the Baltimore & Ohio in the engineering department in 1899 on bridge and tunnel construction. From 1905 to 1908 he worked on the construction of the Washington Terminal at Washington, D. C. He was appointed master carpenter of the Washington Terminal in February, 1908.

W. J. Douglas was graduated from Lehigh University in 1894 with a degree of C. E. After leaving college he was draftsman with the Coxe Iron Manufacturing Co., and the Cross Creek Coal Co., of which the late Eckley Coxe was president. After spending a year and a half with these firms, he became a transit man for the Lehigh Valley Coal Co., and inspector of mine workings for the Lehigh Valley at Hazleton, Pa. In the spring of 1898 he became a mining engineer for F. C. Dininny, Winterpoch, Virginia. In 1898 he was appointed assistant engineer of bridges, Washington, D. C., and at the end of three years became engineer of bridges, which position he held until the first of June of this year, when he became associated with Wm. Barclay Parsons, consulting engineers, 60 Wall street, New York.

J. Dupre started work for the C. & N. W. in 1884 in the bridge and building and water department in Iowa as pump repairman helper. After one year he was made pump engineer and served for six years. Then he was promoted to division pump repairman. He then became general foreman, water department, of the Iowa division, for five years, up to 1901. He left the C. & N. W. and started to work for the Otto Gas Engine Works, of Chicago, and was with them until 1909, building water works of all kinds. Next he went to work for the Southern Indiana as general foreman, water department, and still holds this position.

R. O. Elliott, supervisor bridges and buildings, Louisville & Nashville, was born in Simpson county, Ky., April 5, 1875. He entered railroad service as bridge carpenter on the Memphis division of the Louisville & Nashville in 1896, and was given charge of a building gang in 1900. He was promoted to assistant supervisor, bridges and buildings on the Nashville division of the L. & N. in 1907, and promoted to supervisor, bridges and buildings on the Nashville division 1910, with office at Nashville, Tenn.

Ernest C. George was born in Noltonville, Province of Quebec, Canada, June 23, 1864, educated in the public schools of Emporia, Kan., served two years' apprenticeship as carpenter and joiner, and entered the service of the Santa Fe at Emporia, Kan., April 17, 1882, as carpenter in a building gang, Dodge City division. In May, 1883, he was made division foreman, building and water service, and continued in this position until September, 1884, when he was promoted to general foreman of building and water service construction on various new lines being built in Kansas. He continued in this capacity until May, 1886, when he was transferred to Carrollton, Mo., as general foreman, building and water service construction, on the Chicago, Santa Fe & California between Kansas City and Fort Madison, Ia. In February, 1889, he was transferred to the Eastern division as building and water service foreman, remaining until May, 1890, when he was transferred to the G. C. & S. F. lines in Texas as bridge foreman. He remained on the G. C. & S. F. lines until July, 1891, and was then employed as superintendent of tracks, bridges and buildings by the Chicago, Fort Madison & Des Moines to rehabilitate 40 miles of narrow-gauge railway and construct 38 miles of new road connecting Fort Madison and Ottumwa, Ia. In April, 1893, he became bridge foreman on the A. T. & S. F. at Fort Madison until September, 1894. From 1894 to 1900 he engaged in general contracting at Perry, Okla., and again entered the service of the G. C. & S. F. in 1900 as foreman of a building gang, Southern division. He was appointed roadmaster of the 10th track district January 6, 1906, and appointed general foreman bridges, buildings and water service on May 22, 1906, which position he now holds, with headquarters at Beaumont, Tex.

J. E. Greiner was born in Wilmington, Del., February 24, 1859. He graduated from the Wilmington high school in 1877, entered Delaware College in that year, and graduated in 1880 with the degree of B. S. He also studied civil engineering and obtained the degree of C. E. He began work as draftsman in the Edgemoor Bridge Works in Wilmington, Del., in 1880; 1884 found him assistant engineer for the Keystone Bridge Works. In 1885 he was in charge of the erection of the Seventh street bridge across the Allegheny river in Pittsburgh. In 1886 he entered the service of the Baltimore & Ohio, being successively draftsman, in 1887 inspector, in 1889 chief draftsman, in 1891 assistant engineer. In 1892 and 1893 he became designing engineer of the Philadelphia Bridge Works, in 1894 engineer of bridges for the B. & O., in 1900 engineer of bridges and buildings for the same road, in 1905 assistant chief engineer, and in 1908 in business for himself as consulting engineer. He designed or had charge of the designing and erection of every bridge constructed on the B. & O. between 1885 and 1908. Among the interesting construction upon which he was engaged are the Arthur Kill bridge, which, at the time of its construction, with its spans of 520 feet, was the largest drawbridge in the world; the Ohio river bridge at Benwood, with a 345-ft. span erected without falsework; the design of the Ohio river bridge at Parkersburg and the big double-track bridge at Havre de Gerace, Md., which cost $2,000,000. From 1899 to 1908 he had the supervision of the designing of all the stations and buildings on the B. & O. He has written some strong scientific and engineering papers, and received from the American Society of Civil Engineers a gold medal for a scientific paper. He has lectured at Delaware College and Cornell University. In 1895 he designed and patented a new type of bridge. He holds membership in the American Society of Civil Engineers, the American Railway Engineering and Maintenance of Way Association, Engineers' Club of Baltimore and Engineers' Club of New York, and is chairman of Committee on Iron and Steel Structures of the American Railway Engineering and Maintenance of Way Association, and member of Committee on Concrete and Reinforced Concrete of the American Society of Civil Engineers. Since entering private practice as consulting engineer, Mr. Greiner has been retained by the Baltimore & Ohio, the Erie, the Norfolk & Southern in connection with a bridge five miles long across the Albemarle Sound, the Peoria & Pekin Union in connection with a large double-track bridge across the Illinois river, the Carolina, Clinchfield & Ohio for a large number of bridges. He was appointed member of a commission of four engineers to report upon the strength of the Blackwell's Island bridge across the East river in New York. Immediately after the great fire in Baltimore he was appointed a member of a commission to examine into the safety of the large structures which had been damaged by the fire. He has also been retained as consulting engineer for the Kentucky and Indiana bridge to be built jointly by the Baltimore & Ohio, the Southern Railway and Chicago, Indianapolis & Louisville over the Ohio river at Louisville, Ky.

H. M. Henson was born in Eureka, Lyon County, Ky., March 22, 1855. He received a common school education, and later worked as farmer and wood merchant for his father until the age of 21. He began railroad work April 1, 1876, with the contracting firm of Reed & Flannery at Point Burnsides, Ky., on the construction of the Cincinnati Southern. He left this company March 1, 1877, to enter the bridge department of the Paducah & Elizabethtown, now part of the Louisville division of the Illinois Central. He left this road May 15, 1881, to go with the St. Louis, Iron Mountain & Southern in the bridge and building department, and stayed there until February 2, 1882, when he went to work for Mr. Decatur Axtell at Rich-

mond, Va., on construction of the Richmond & Alleghany, now the James River division of the Chesapeake & Ohio. On December 15, 1886, he entered the service of the M. K. & T. in charge of a pile driver on reconstruction of the line south of Denison, Tex. January 1, 1888, he went with the Cotton Belt on reconstruction of bridges and building, and was with this company until May 20, 1892. From there he went to the Carter Construction, of St. Louis, on construction of the C. B. & Q., from Old Monroe to St. Louis, and stayed with this company until March 15, 1893. On November 1, 1893, he went to work in the bridge and building department of the Clover Leaf, in charge of a pile driver on reconstruction, where he stayed until November 30, 1898. August 1, 1889, found him with the Chesapeake & Nashville, now a part of the L. & N., where he was superintendent of maintenance of way. He was next with the Bess Line Construction Co. as superintendent of bridges and buildings on the Denver, Enid & Gulf. On July 1, 1907, he entered the service of the Colorado Southern, New Orleans & Pacific as superintendent of bridges and buildings at Beaumont, Tex., and left them February 1, 1908. He built the Beaumont city wharf in 1909 and has now been with the Santa Fe as inspector of masonry on construction for a year at Beaumont, Tex.

Lee Jutton, general inspector of bridges, Chicago & North-Western, is a graduate civil engineer. He has had a varied experience in the field and drafting room in connection with bridge construction, and was appointed to his present position, January 15, 1907.

A. E. Killam was born in Canada, and at an early age was interested in the mechanism of bridges. Among some of those that were built under his supervision were the bridges over the Richibucto, Cocagne, Buctouche, Hampton at the Ferry, Perry's Point, three across the Kennebeccasis, the Hammond river at Barnesville, one at Aroostook, one at Sydney and one across the Petitcodiac at Moncton. He also built 65 others of considerable magnitude. He built the Albert County railroad and was manager of the line for several years. He also completed and equipped the St. Martins & Upham. He was elected to the new Brunswick Parliament and sat for 19 years, till 1907. Just two years before his term expired he resigned and accepted the office of bridge and building inspector for the Intercolonial railway, with headquarters at Moncton, N. B., which position he now holds.

J. S. Lemmond, engineer of maintenance of way of the Southern Railway, Charlotte, N. C., was elected president of the American Railway and Bridge Building Association at its convention in Jacksonville, Fla., October 10, 1909. He has been a member of and a hard worker for the good of this association for a number of years. He was born in Walton county, Georgia, in 1851. His boyhood was spent between work on a farm and attending school. His first railroad work was as section laborer on the Georgia Railroad from August to December, 1869. He then returned to farming and, with the exception of three months at school in 1870, he remained on the farm until 1883. During this period he was ambitious to get a thorough education, but circumstances were such that he could not take the time from business to attend school. He began studying systematically at night and at odd times. The first of the year 1883 he secured a position as section foreman on the East Tennessee, Virginia & Georgia, a part of the present Southern Railway, which he held until March, 1886. He then served as conductor on a work train for a year and a half, then as track supervisor for about three years. In May, 1890, he was made roadmaster, and held this position for nine years. He was then appointed superintendent of track, bridges and buildings, and remained in this position until August, 1900, when he was again appointed roadmaster at Atlanta, Ga. On July 1, 1906, he was appointed to his present position, engineer of maintenance of way, for the Eastern district of the Southern at Charlotte, N. C.

Calvin A. Lichty, inspector, purchasing department, C. & N. W., secretary American Railway Bridge and Building Association, was born at Waterloo, Ia., May 24, 1865. He was educated in the public schools of Waterloo and the state University of Iowa at Iowa City, graduating with the degree of civil engineer in 1890. He worked one year on the government survey of the Missouri river from Kansas City to its mouth. He was draftsman one year for the Lake Erie & Western at Indianapolis, and entered the service of the Chicago & Northwestern in the summer of 1892 as assistant engineer on the Madison division at Madison, Wis. Since that time he has occupied the positions of division engineer, superintendent of bridges and buildings, engineer on construction work, and inspector of purchasing department, having been in the last position since 1905.

H. C. McKee was born at Rochester, N. Y., August 8, 1874, and attended public school until 16 years old. He put in two seasons on the great lakes on sailing vessels and entered the service of the Rochester Bridge & Iron Works in 1893, becoming foreman in 1898. He was foreman for Ike Kinne, contractor, Buffalo, in 1899, and foreman for the Elmira Bridge Co. at the time of the organization of the American Bridge Co. He was with this company until 1901, when he went to the Central of Georgia as bridge foreman, returning to the American Bridge Co. in 1902. He returned to the Central of Georgia in 1903 as iron bridge inspector.

R. J. McKee was born on the 12th of March, 1861, at Pittsburg, Pa., and was raised on a farm in Allegheny county until he was 17 years old. From that time until he was 20 he steamboated and mined coal in and around Pittsburg. On March 1, 1881, he went to Iowa, and on the 22d of November, 1881, commenced railroading on the Iowa Central out of Marshalltown as bridgeman. In the fall of 1886 he was promoted to foreman and continued to work for the road until February 1, 1894, when he resigned. On March 1 he became foreman on the Illinois Central. January 1, 1896, he was appointed supervisor of bridges and buildings on the Springfield division at Clinton, Ill., holding this position until April 1, 1906, when he was transferred to the St. Louis division as supervisor of bridges and buildings. He was again transferred to the Freeport division April 1, 1908, at which place he is now located.

J. Schaffer, supervisor of bridges and buildings of the Rochester division of the New York Central, at Rochester, was born in Buffalo, N. Y., in 1861. He was educated in the public school and Canisius College, Buffalo, and then learned the trade of carpenter and builder with his father, a building contractor in the city of Buffalo. After working for the firms of Graigie, Rafferty & Yeomans Co., Buffalo, McKenzie Bros., Ashtabula, Winship Brothers and Mathews Brothers, Minneapolis, Minn., and Grattan & Jennings, Buffalo, for a number of years, he commenced working for the New York Central in 1889 as carpenter foreman and was appointed general foreman in 1902. He was promoted to supervisor of bridges and buildings on the Rochester division in 1909, which position he now holds.

R. P. Mills, at the age of 20, served his time as carpenter, joiner and stair builder. In 1882 he drifted into heavy work, and took a position with the New York, Chicago and St. Louis as foreman of bridges and buildings, remaining with that company until 1899, at which time he went to the New York Central & Hudson River as general foreman of buildings on the Eastern division. In 1903 was promoted to supervisor of buildings on the same division.

Albert Mountfort, when twenty-five began building bridges, as foreman on railroads for four years. Then he went to Fort Monroe, Old Point Comfort, and rebuilt the government wharf. Next he went to work for a bridge company erecting bridges through the southern, western and north-

ern states for about six years, when he went to work for the Maine Central as foreman of bridges for five years Since then, 23 years, he has been employed as supervisor of bridges

R. J. Mustain in the year of 1892 accepted a position with the A. T. & S. F. as piledriver and bridge foreman, and served in that capacity until 1899. He resigned in 1899 and acted as piledriver foreman for the Southern Pacific during the year 1900 on the Tucson division. On February 1, 1901, he was made general foreman of bridges and buildings on the El Paso Northeastern, and served with them until 1905. In that year the road was sold to the El Paso & Southwestern and he continued in service with them as bridge building superintendent until 1906. October 1, 1906, he went into business for himself in El Paso, Tex. In August, 1907, he sold his business and accepted a position with the American Light & Water Co., of Kansas City, and served with them on the construction of thirty-five miles of the Bonito pipe line, this work being done under contract for the E. P. & S. W. In November, 1908, he commenced work as superintendent of construction of the extension of the Bonito pipe line, and at its completion was placed in charge of the line, in which capacity he is now serving. The line consists of one hundred and thirty-four miles of pipe, furnishing water for the E. P. & S. W.

J. F. Parker was born at Mount Desert, Hancock county, Maine, August 18, 1845. He received a public school education at that place and in 1863 entered the merchant marine service in sailing ships out of Boston in the Mediterranean trade. He followed this occupation until 1872, attaining the position of master. From 1872 to 1882 he was engaged in ship building at East Boston, and in February, 1882, went to California and located at National City. In 1883, he entered the service of the Southern California Railway as carpenter. May, 1886, to April, 1887, he was carpenter gang foreman. From April, 1887, to date, he has been general foreman of the bridge and building department of the Los Angeles division, Coast Lines, A., T. & S. F at San Bernardino, Cal.

Samuel Folsom Patterson was born in Hopkinton, N. H., January 23, 1840. He served in his youth three years in the Army of the Republic as a private, re-enlisted in 1865, and was commissioned first lieutenant, serving until the regiment was mustered out. Before entering the army he was an employe of the Concord Railroad (afterwards the Concord & Montreal, now the Boston & Maine), and resumed his relations with the road on his return as foreman of the bridge department, becoming in due time superintendent of bridges and buildings, having now served the roads forty-six years. In 1895-96 he was alderman of Concord, N. H., and in 1897-98 was representative. He served eighteen years as secretary of the American Railway Bridge and Building Association, resigning October, 1909, when the association apappointed him secretary emeritus.

J. N. Pennell, supervisor bridges and buildings, Lake Erie & Western and Northern Ohio, spent his boyhood in the country near Ft. Wayne, Ind. He moved to New Lisbon, Ind., with his father at the age of fifteen and worked at carpentering. He left school at 18, three weeks before graduating from common school, to accept position on the P. R. R., completing his studies on the road at night, and returned home to graduate with the class. After a few months he took a position as carpenter in the Cambridge City Car Works. Later he went to work for a contractor and builder. Early in 1886 he went to work in the bridge department of the Ft. Wayne, Cincinnati & Louisville and was promoted to foreman in 1892 at Muncie, Ind. He continued on the same division until 1902, when he was made assistant supervisor, working at Tipton, Ind., and on April 1, 1903, he was made supervisor.

W. W. Perry, when a young boy, learned the carpenter trade and studied architecture. After completing his apprenticeship he engaged in contracting and building work until August, 1864, when he went to the Catawissa Railroad as foreman carpenter of bridges, buildings, etc. In January, 1867, he was made master carpenter, when, in the fall of 1872 the Philadelphia & Reading leased the Catawissa Railroad, and he remained as master carpenter of what was then the Catawissa & Shamokin division. In July, 1903, he was promoted to master carpenter of the P. & R. system and still holds that position, with headquarters at Williamsport, Pa.

Benj. P. Phillips was born in Coventry, R. I., August 27, 1861. He entered the service of the New York & New England as an apprentice in Hartford, Conn., in 1879, and has served that road in different capacities ever since. He is at present in Willimantic, Conn., as foreman of the Midland division of the New York, New Haven & Hartford.

B. F. Pickering was born in Wakefield, N. H., October 5, 1857, and was educated in the schools of that place and Somersworth, N. H., and Eliot, Me. He entered the service of the Eastern R. R. as passenger brakeman October, 1885, and left to accept a position with the United States government at Portsmouth Navy Yard. He re-entered the service of the Boston & Maine as carpenter at Sanbornville, N. H., October, 1893, and became supervisor of bridges and buildings on the Northern division. In 1903 he was made general foreman, in charge of the Conway branch, which position he held until August, 1910, when the Eastern and Western divisions were united as the Portland division, when he became general foreman in charge of bridges and buildings for the entire Portland division, with office at Salem, Mass. October, 1898, he joined the Association of Railway Supervisors, B. & B., and was elected president October, 1902.

J. O. Potts, assistant engineer, maintenance of way, Missouri Pacific, at St. Louis, Mo., commenced work on the P. C. C. & St. L., Pittsburg division, in 1884, as a bridge carpenter, and has held numerous positions in the maintenance of way department, most of his time having been spent on the timber. He has handled the crosstie proposition for the last 20 years, and it is his opinion that no part of railroad work calls for more consideration today than the timber question. He has worked on nearly all divisions of the P. C. C. & St. L. and P. F. W. & C., and over the entire B. & O. system, and the B. & O. S. W.

C. E. Powell, supervisor, bridges and buildings, of the Chesapeake & Ohio, at Hinton, W. Va., entered the service of that company when 18 years old, in 1880, as bridge carpenter, and was made foreman in 1885. In 1888 he was made assistant supervisor of bridges and buildings, and in 1902 was made supervisor of bridges and buildings.

W. T. Powell has railroaded nearly all his life, commencing as a water boy in a grading outfit in Illinois at the age of 13. Since then he has worked in nearly all departments of railway construction and track maintenance through Missouri and Iowa. He began bridge work on the D. & R. G. in 1883. In November, 1884, he entered the services of the C. & S. as bridgeman. During the year 1886 he was with the F. E. & M. V. in Dakota. He was made bridge foreman for this company in 1888 and general foreman in 1900, and superintendent bridges and buildings in 1906.

Geo. W. Raer was born in Ontario, Canada, 37 years ago and held various positions in the bridge and building department of the Grand Trunk from 1890 to 1901. Since 1901 he has been with the Southern Pacific, four years as assistant general bridge inspector of the lines west of El Paso and Sparks and south of Ashland, Ore., and as general bridge inspector since August, 1905.

H. Rettinghouse, division engineer, Chicago & North-Western at Boon, Ia., was born July 30, 1861, in Germany and

obtained his education in that country. He emigrated, October, 1882, shortly after graduating. In 1883 he assisted in land surveying and timber estimating in northern Wisconsin, in 1884 was rodman on the Wisconsin Central, St. Paul extension. In the fall of 1884 he entered the service of M. L. S. & W., now the Ashland division, C. & N. W, as rodman on construction and remained uninterruptedly in the service of that company until October, 1893, being successively leveller, transitman and resident engineer on construction, assistant engineer in maintenance work during the last four years of this period, and was in charge of track, masonry and dock work. He left the service in October, 1893, to become assistant city engineer of Ashland, Wis., in charge of street pavement, and was elected city engineer of Ashland, Wis., in the spring of 1894. He held that position until the spring of 1897. During this time he was also engineer in charge of location and construction of a narrow gauge railroad in Bayfield county, Wis. (A., T. & I. R. Ry, now abandoned), and conducted a general engineering business, continuing it after

F. E. Schall was born in southern Germany in 1857, and educated from 1864 to 1871 in the public schools, and from 1871 to 1872 in the Preparatory School. During the winters from 1873 to 1878 he attended the Royal Building Trade Schools at Stuttgart, Germany. During the summer seasons from 1875 to 1878 he was assistant to railroad contractors in the Middle States of Germany From 1878 to 1881 he served in the German army; 1881 to 1883 he was in the stone business at Easton, Pa., and 1883 to 1886 was draftsman on the engineering department; from 1886 to 1887, chief draftsman; 1888 to 1889, chief draftsman and assistant engineer; 1889 to date, bridge engineer. at South Bethlehem, Pa.

A. Shane, during '66 and '67, was employed on the Louisville & Nashville, repairing damage done during the war; '68 to '70, inclusive, he was with the Louisville Bridge & Iron Co., engaged in erecting the bridge over the Ohio river at Louisville, Ky., now on the Pennsylvania. After the completion of the Ohio river bridge, he continued with the Louisville Bridge & Iron Co. as foreman in erecting bridges in various parts of the United States, up to 1875. Then he returned to Louisville, Ky., accepting a position with the Louisville Bridge Co., having charge of repair and maintenance of the Louisville bridge, remaining in that position until 1880. From that time until 1884 he was with the Keystone Bridge Co., at Pittsburg, Pa., as foreman of erection of superstructures. During this time he erected the first double-track, steel bridge over the Monongahela river at Pittsburg, on the Pennsylvania, also on the Pittsburg and Youghogheny over the Youghogheny, at Broad Ford, and a high viaduct over Lyon Brook in New York, on the New York, Ontario & Western. While with the Louisville Bridge & Iron Co. he was in charge of the erection of steel bridge over the Tennessee river on the Nashville & Chattanooga at Bridge, Pa., and at Decatur, on the L. & N., and over the Alabama river, at Montgomery, Ala., and many other structures of less importance on more than thirty different railroads. In 1884 he accepted a position as supervisor of bridges and buildings on the Chicago division of the C. C. C. & St. L., holding this position until 1898, when he was appointed superintendent of bridges and buildings on the Toledo, St. Louis & Western. In 1902 he was appointed superintendent of maintenance and way of that road, remaining until June, 1907, at which time he was appointed chief inspector of the railroad commission of Indiana. On Oct. 1, 1910, he became general manager of the Indianapolis, Columbus & Southern.

J. B. Sheldon was born in Rhode Island and educated in the public schools of that state. He entered the service of the New York & New England bridge and building department in 1882, and left that road in 1885 to go with the New York, Providence & Boston, where he served four years as foreman of bridge reconstruction. He was made master carpenter of the Worcester division in 1890, having charge of bridges, buildings, masonry and structures. When this company was absorbed by the New York, New Haven & Hartford in 1892, he remained with duties unchanged, having the title of supervisor. At the present time he is supervisor of bridges and buildings, Providence division of that road, at Providence, R. I. He served as vice-president of the American Railway Bridge and Building Association and was elected president in 1905, being the fifteenth president of the association.

J. P. Snow, chief engineer, Boston & Maine, Boston, Mass., graduated from the Thayer School of Civil Engineering connected with Dartmouth College in 1875. Previous to entering that institution he lived on a farm in southwestern New Hampshire. In 1879 he entered the service of the Boston Bridge Works, leaving the position as engineer of that company in 1884 for a position in the office of J W. Ellis, of Woonsocket, R. I., the work being mostly in connection with bridges on the then Providence & Worcester, Now a part of the New Haven system. In 1888 he entered the service of the Boston & Maine as bridge engineer, which position he held until 1909 when he was made chief engineer.

G. H. Soles, superintendent bridges and buildings of the Pittsburgh & Lake Erie, was born in McKeesport, Pa., on February 10, 1850, and was brought up on a farm near there until 17 years old. He received a common school education and then went to Braddock, Pa., where he became engaged in the carpenter and boat-building trade. On May 28, 1872, he was employed as a bridge and road carpenter on the Baltimore & Ohio, with headquarters at Pittsburgh, Pa. On May 1, 1874, he was promoted to foreman of carpenters and remained with the B. & O. until October 31, 1881, when he resigned to accept a similar position with the Pittsburgh & Western at Pittsburgh, Pa. On July 1, 1886, he was promoted to master carpenter and remained in this position until July 15, 1889, when he became master carpenter of the Pittsburgh & Lake Erie at Pittsburgh. On December 1, 1902, he was made superintendent of bridges and buildings.

F. L. Thompson, engineer of bridges and buildings, Illinois Central, Chicago, Ill., graduated in civil engineering in the class of 1896 from the University of Illinois and entered the service of the Illinois Central in June, 1896, and has been with that road continuously since that time. From 1896 to 1903 he was in the construction department as chainmain, rodman, assistant engineer and division engineer. The work consisted mostly of grade revision and double-track work. From 1903 to 1907 he was roadmaster of the Chicago and Louisville divisions, from 1907 to July, 1910, assistant engineer of bridges, and from July 1 to date engineer of bridges and buildings.

J. B. White located with his parents in Cedar Rapids, Ia., in 1871. In the same year he commenced railroading in the bridge and building department of the B. C. R. & M. In 1874 he was transferred to the water service and was employed in several different capacities until in 1879 this road expanded and built several branch lines, when he was made assistant supervisor of water service, which position he held until 1901. When the C. R. I. & P. bought the road he was made supervisor and held this position until 1904, when he accepted a position with the C. & N. W. as foreman of water supply of the Iowa division, which position he still holds.

E. E. Wilson, supervisor of bridges on the Eastern division of the New York Central, was born April 29, 1871, at Greenfield, Ia., and was raised on a farm, remaining there until 18 years of age. He then served three years as an apprentice blacksmith in Des Moines, Ia., after which he entered the maintenance of way department of the Chicago Great Western at Marshalltown, Ia. He worked there five years as bridgeman, and was then put in charge of a gang. On March 1, 1902, after

three years as inspector he was promoted to the position of bridge supervisor on the Eastern division, which position he still holds.

serving five years as foreman, he severed his connection with the Chicago Great Western to accept a position as bridge inspector on the New York Central at New York. After serving

K. J. C. Zinck spent six years on the Pennsylvania Lines west of Pittsburg. He has been assistant engineer and division engineer on the Chicago & North-Western, division engineer on Chicago, Rock Island & Pacific, and for the past five years, assistant to the chief engineer, Grand Trunk Pacific at Winnipeg, Man.

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Contents

CONFISCATION.

COMMENTING editorially on the testimony of before the Interstate Commerce Commission at the rate hearings in Chicago, the "Chicago Tribune" said under the caption "Strong and Weak Railroads"—

> "I admit that what might be justice to some lesser line would extravagantly increase us, if you please, but I have not the wisdom to say how that thing shall be disposed of." This was the reply of the vice president of the Northwestern to the query of an interstate commerce commissioner.
>
> It is conceded that competing roads must charge the same rates. That is necessary, though one may be strong and the other weak, though one may have cost much less or be capitalized for much less than the other. But the rates which may be reasonable for one road, providing sufficient revenue for maintenance and betterments and yielding a fair return to the owners, might "extravagantly increase" the earnings of another road. Yet the weaker lines must not be allowed to starve. They must be kept in good shape.
>
> The vice president of the Northwestern does not know how to deal with the situation. Prof. Adams, the learned statistician of the Interstate Commerce Commission, has suggested a solution. It is that the rates shall be high enough to take care of the weaker roads and insure a reasonable return on the investment; that the stronger and more profitable roads, while charging the same freight rates, shall be restricted to the same rate of return or profit, and that whatever surpluses there may be shall be turned into the United States treasury. That would equalize conditions as far as the railroads were concerned. If shippers had to pay a particular road rates which were unduly high as far as it was concerned they could find consolation in the thought that the excess swelled the revenues of the national government, and did not go to pay dividends.
>
> It is hardly necessary to say that Prof. Adams' suggestion has had no cordial response in railroad circles. One of the organs of Wall street sentiment has condemned it, but has not proposed any other method of solving the problem. But it must be solved. We must, while escaping the danger of stinting the weaker roads and impairing the value of their service, avoid the mistake of unduly enriching the stronger ones.

In other words, if one road employs efficient management, and is thereby enabled to make money on rates which would throw a competing, poorly managed road into bankruptcy, the inefficient road must be protected by having rates raised; but the surplus accruing therefrom to the better road should be given to the public, confiscated. Or, to state it differently, wisdom and efficiency must be penalized, leveled off to a par with the least fit. Or, again, the primal law of nature, the survival of the fittest should be set at naught and defied. This is socialism, worse, anarchy with a vengeance. Truly, government ownership spoils system and all were preferable. Under such conditions, wherein would lie the incentive to effort toward betterment of properties and increase of facilities?

And what of the ambitious railroad employee? With the leveling of the roads would follow the leveling of the man, in number or quantity or both for if efficiency in management were penalized, managements would rapidly become inefficient and less efficient men or the same number of inefficient ones would be required to run the roads. Is it any wonder that the great railroad unions have at last risen and demanded a square deal for the roads with the threat of going into politics to get it if it can be had in no other way?

LIES.

THERE ARE VARIOUS kinds of lies. The most pernicious is misrepresentation; the telling of a half-truth or the perversion of the truth. The report has been widely circulated in the daily papers that the increase in net operating revenue of the railroads of the country for the fiscal year just past had increased 110,000,000 dollars over the previous corresponding period. Even were this the exact truth so far as it goes, it would yet remain a deliberate perversion of facts for the purpose of deceiving the public. Suppose, for the sake of argument, that it were so; what of recent increases in wages, in the cost of equipment and supplies, in taxes, in expenses incurred in obeying the laws, such as publishing of tariffs, for one example? This statement dovetails in nicely with a former report to the effect that the roads were padding their operating accounts, when everyone who comes in contact with railroads or the national government knows that the roads dare not keep their accounts in any manner other than that prescribed by the Interstate Commerce Commission.

THE SIGNAL DEPARTMENT.

THIS MONTH WE publish the standards of two roads, the Southern and the Boston Elevated. The Southern has very little of a novel nature to show, having determined on the policy of adopting the standards of the Railway Signal Association as fast as they are approved. This is a course greatly to be commended, tending, as it does, to simplify greatly the task of the supply men and the signal

department in that uniformity is secured and chances for error minimized, all of which tends in the long run to reduction of cost. The standards of the association are necessarily compromises, and no doubt are far from perfect as a natural result, but no road could do better than to follow the example of the Southern in this respect for the good of the art and the treasury of the road.

The standards of the Boston Elevated are particularly interesting, inasmuch as they illustrate the two radically different methods of handling automatic block signals on an electric road. The older method, using direct current track circuits, is in use on the portion of the road first put in operation, while the later sections are equipped with the modern alternating current track circuit and light signals. It is interesting to compare the Boston Elevated d. c. track circuit with that in use on the South Side Elevated in Chicago, described in our issue for March of this year. The two illustrations differ radically in many particulars, and both are reported to give excellent satisfaction. That used in Boston is the older.

Report of Committee on Electrification.

(Continued.)

As the report considers the matter of trunk line electrification exclusively, it is well to understand just what we mean by trunk lines before we start to electrify. Trunk lines, as they suggest themselves to me, are lines connecting large cties which are separated at some considerable distance. The portion of a trunk line which lies in the immediate vicinity and outlying districts of those cities will carry upon it a suburban traffic. The companies that have before them the consideration of electrification of their trunk lines have been brought to this consideration either by the public desire, mandate of law or for economical reasons. For the present, the question of electrification of steam roadbed in the vicinity of or between small cities with light traffic cannot be considered, except where physical requirements such as matters of tunnel or grade are concerned. Therefore, it is safe to say that in view of this electrification problem being relegated to the heavier type of traffic between large cities and to their suburbs, it necessarily follows that large power generation and large unit train utilization is the consideration. Further, it is patent that suburban zones call for a considerable track mileage. There is a zone (small city interurban) in which the direct current third rail electrification may be more economical than the alternating current single-phase system, but in my opinion its (third rail D. C.) application cannot be found to apply to any trunk lines considered in part or whole, connecting the larger cities of this country. The reason for my belief that this is so is that the fixed charge and attendant operating expense over the mileage necessary to cover the suburban radius of large cities, taken in connection with density of traffic common to these lines, is less for the single-phase system. In as far as the interural trunk line territory is concerned, it seems to be the committee's opinion that single phase is the logical solution.

Again, under systems of electrification I find the committee recommending as follows: "The direct current railway motor is better than the single-phase railway motor of today, but for long distance work the distribution system for single phase is simpler than for direct current." This paragraph, it would seem to me, would come closer to the situation if the word "cheaper" were substituted for both the words "better" and "simpler." In a recent article by Mr. Philip Dawson, an English engineer of considerable single-phase European experience, he rapped us pretty hard on the alternating current—direct-current combination—and although my own road is involved in such an arrangement I cannot but compliment and agree with Mr. Dawson in his clear exposition of the case.

Thus I would say with reference to the closing paragraph of the committee's report, which reads: "Unfortunately the two overhead wires or third and fourth rails (if temporary low voltage must be used in city streets, tunnels, railroad yards and the like) would in many cases render this system objectionable. Moreover, this motor cannot work on direct current, so that a combination of alternating and direct current system could not be arranged, should it be desirable." I am constrained to take my hat off in recognition of this intelligent quality of the polyphase motor. The accommodating versatility of the single-phase motor did indeed materially contribute to solving a most complex problem, when the New Haven road faced the direct current electrification into New York city, but please pause with me before deifying this attribute! Let us heed this good advice that comes from across the water and avoid such combinations in the future.

Now, with reference to the paragraph which reads as follows: "The principal systems of electricfication used in the United States are the direct-current system and the high potential single-phase system. Frequently, the difference in the estimated cost between these systems, considering both first cost and cost of operation, is so slight that the decision cannot be made on the cost basis alone."

This may be correct for interurban roads, but five years of engineering, construction and operating experience on a trunk line property permits me, with apologies to the committee, to present a firm but respectful disagreement.

Under the heading "Disadvantages," the matter of increasing danger to employes, due to the presence of the overhead conductor, especially in yards or terminals, comes up, but I can hardly justify this as a disadvantage. There is no necessity for employes to be on the top of cars, and the many accidents that have been due to their being there will be eliminated by it being a regulation to keep off the roofs. Of special importance is the contrast to be drawn between the safety of operation, particularly in yards, in favor of the overhead vs. the third-rail system.

Item five, of "Features to be considered for future electrification," suggests the advantage of the alternting current over the direct-current system, in view of its own automatic avoidance of electrolysis.

Item five, of the "Conclusions" of the committee, tells us that the method of passenger, terminal and suburban service has been settled, but inadvertently the specification of method is omitted. If my interpretation of this paragraph is to include that passenger, terminal and suburban service of a trunk line is to be served by direct current third rail electrification, I am in complete disagreement. Again, if the committee is in agreement that trunk line operation is in the experimental stage, when it has been demonstrated without peradventure of a double that the single-phase form of electrification presents the highest economy, consistent with reliability of service from a point of investment cost and operating expense, again let me file my complete disagreement with the committee's conclusions.

My general exceptions to the committee's report, I trust, will not too greatly offset the feeling which I doubtless share with many for the earnest effort that has been made, and the very useful suggestions that have been brought in their report.

My firm belief in the single-phase system being the proper agent for trunk line operation, both freight and passenger, terminal and suburban traffic included, is based upon a conscientious effort to secure the facts within a situation that actually exists. The early prejudice against the high voltage overhead system has been dissolved, in the record of no passenger fatalities, more firmly establishing, in my mind, the truth that the high voltage contact conductor out of reach

is safer than the low voltage contact conductor within reach. From these minor yet influential factors there has now come to us to-day the major and fundamental commercial facts that cannot be overlooked by the boards of directors of railroads who are necessarily on the verge of a heavy expenditure in electrical equipment, and thus with these beliefs, with the reasons as herewith given, I am sure the committee, for the sake of discussion of their report, will accept with grace the exceptions to their conclusions that I have cited.

Mr. Basford: Conclusion No. 7, "each problem must be studied on its merits and a decision can only be made after careful study of the conditions pertaining to each situation," is a truth which illuminates the entire situation. The use of electricity on steam railroads at present can be justified in but very few cases on the grounds of economy.

A few years ago it seemed quite possible to use electricity economically on many of the mountain grades of this country, tive has postponed the day when electricity can be economibut the development of the Mallet articulated steam locomohave been investigated and large steam locomotives have been found to be more economical, all things considered, even when water power is available for generating electricity, but it is still true for such situations as well as for terminals and others more complicated, that each case must be investigated by itself and settled upon its own merits.

Commenting upon the historical feature of this report, the committee calls attention to the fact that the installations cited were applied on the account of special circumstances surrounding each case and that none of them involve heavy trunk line service for any extended distance. Again the committee says: "So far electrification has generally been applied in trunk line steam railroad service only where physical restrictions, such as tunnels or heavy grades, occur."

With these successful applications before us there can be no question that there is a field for electrification, and that this field is being satisfactorily occupied, but it is quite evident that there are fewer opportunities for electrification than have been predicted.

We do not hear as much as we did concerning the electrification of long distance main trunk lines. It is evident that serious consideration of electrification over long distances is not being talked about as much as formerly. In connection with this service, as well as on mountain grades, it is important to bear in mind that the possibilities of the steam locomotive have been by no means exhausted. Up to the present time American railroads have given so high a place to the importance of plain, rugged locomotives that would be sure to get over the road that in general they have deferred the consideration of refinements making for increased efficiency and economy. Before electrification can come into extended use for main line work these refinements will be taken up. They will be found to improve efficiency and increase economy at less cost than the same improvements can be had from electrification. It is important also to remember that the limits of the capacity of the steam locomotive have not been reached.

The successful electrification of such an important terminal as the Grand Central station in New York illustrates the value of electricity in meeting conditions where cost is not the controlling factor. The capacity of the terminal is increased and the elimination of smoke is a vital factor. There will be other cases where electrification may properly be considered, but as is clearly shown in this report each situation is a case by itself, requiring individual study and treatment. This is particularly true in connection with freight terminals, which present specially difficult problems.

It is exceedingly important that discussions of this subject should develop appreciation of the immense proportions and complicated character of the questions involved, so that the public will not crowd the railroads hastily or unfairly. Perhaps the most important of all the conclusions reached by this committee is that the steam railroad men and electrical engineers should work together in as close harmony as possible, so as to produce results that will be as free from mistakes and experiments as is possible in any developing art.

Mr. Frederick C. Syze: While I have never had any experience in the handling of electric trains there have been occasions when I confess I couldn't help wishing I had. Those occasions were when our most important terminal was working under pressure, so to speak, and when the steam locomotive was the governing factor in getting trains in and out of the terminal. This point seems to bear quite pertinently upon what has already been written and said about the train-handling capacity of present terminals being increased by the substitution of the electric train for the steam locomotive without increasing track facilities.

I have one particular occasion in mind, on which, in the handling of a heavy holiday traffic, the trains on one district were running on about a five-minute headway at times, together with trains running on a somewhat longer interval on another district, the trains from both districts using the terminal I have spoken of. It was only by the sharpest kind of work on the part of all hands that the terminal could be kept working with any degree of freedom; and it was the movements of the engines about the terminal that caused the heaviest tax upon it. On this occasion, as well as on many others, it was found necessary to provide the second relay engine for the heavier district to insure always having an engine ready to grab the trains as soon as they were unloaded and reloaded, and to get them out of the terminal to make room for other incoming trains, as well as to work the equipment to the best possible advantage.

I could not help thinking then, as now, that if such a pressure had to be sustained for a practically indefinite period, or had to be increased, the terminal would have great difficulty in handling it with the steam locomotive; whereas, under the same pressure of traffic with electric trains, the terminal's capacity would be increased 100 per cent. The same conditions exist even under normal traffic when blockades or other delays occur out on the line and trains enter the terminal in convoys. No matter how large the terminal is within reason—and it is not a loop—there comes a time under such conditions when all receiving tracks are full and locomotives have got to be moved around the terminal to get trains out of the way so incoming trains can enter. In moving the engines around the terminal either to take these trains out on the line again or to storage tracks, the "throat" of the terminal is tied up until the engines move inside the interlocking clearances, tying up the main tracks meanwhile.

Then again engines have got to take water, coal, clean fire, and where not double-headers, turn; and it occasionally happens that a fireman, in his anxiety to get his engine ready in a hurry, or has a bad grade of coal, will clean his fire too fine or lose it; it always seemed to me that this happens at the most critical moment. Now, on the other hand, instead of the engines moving to and from the coal-pocket and turn-table or to and from waiting tracks, with the terminal under pressure, electric trains intact, and in actual service, could move in and out on the same line-up of switches that was given the light engines. I believe that about 60 per cent of our terminal movements is made by light engines running about in the manner I have mentioned; and in most cases, because of the unavoidable short and narrow "throat" of the yard, these movements tie up the main line.

Then again there is always the irritating delay under heavy traffic conditions in coupling the relay or switching engines to the trains that have just arrived and which have got to be moved out again within the shortest possible time. With heavily-loaded trains of six and seven cars two or three minutes are consumed in the unloading—and in some

cases in reloading—during which it is hardly safe to couple the engine to the train, as the engine might hit the train hard enough to cause some one to lose his balance and get injured in spite of the injunction to "Watch your step." So after the passengers are off and on, and the engine is coupled, the brake and signal hose have to be coupled and brakes tested, and safety-chains hooked up, before the train can move out of the terminal. Now, with the electric train it is obvious that all the time consumed in coupling the engine, etc., would be saved; as, so soon as the last passenger stepped on or off, the train could move out of the terminal. Under these pressing conditions every half-minute counts. I believe, too, that in a given short interval of service—I am referring, of course, to a purely suburban proposition—that for about every five trains, or five sets of cars, handled by steam locomotives, four electric trains would give the same service on account of the time saved at either end of the run by not having to wait for the engine to get around, etc., aside from any possible increases in running time. It has also occurred to me that on account of the high percentage of light engine movements much wear and tear on frogs, switches and rails in busy terminals must necessarily be saved by the use of the electric train on account of the elimination of the light engine movements. The prolonged necessity for renewals of whatever kind obviously carries with it more or less economy.

But, on the other hand, under regular working conditions, particularly with the through, or longer, runs, where there is ample time at either end, we experience no difficulty at all with the steam locomotives; it is only where the minutes at terminals count, so far as the actual train operation is concerned—aside from cleanliness and the other advantages claimed for electrification—that the need of the electric train is most felt.

I have been wondering whether Mr. Gibbs might not be good enough to tell us whether the Long Island properties experience any difficulty in handling the ordinary local freight business in connection with the electric trains.

Mr. Gibbs: No, there is no difficulty at all, except the frequency of trains; but the freight handling is not interfered with at all.

Mr. Syze: Mr. Murray said something about no one being required to ride on the top of box cars. To be sure that has been largely done away with by the extensive use of the air brake; but there certainly are times when men must be on top to set brakes and give signals—signals can't always be given from the ground. And although I concede that the men do not have to ride on top as much as they used to with nothing but the old hand-brakes, I shall have to take exception to Mr. Murray's statement.

Mr. C. O. Mailloux: One of the previous speakers said that the electrical engineer has helped to find some mysteries or to locate them. He might even have gone further than that by saying that the electrical engineer has helped to unravel some very important mysteries, and has located and made known some principles and factors of the highest importance in the economics of traction. For several years past I have, each year, delivered courses of lectures on electric traction to students of various technical schools. This work, in addition to my own practice as a consulting engineer, has made it necessary for me to familiarize myself with the theory and practice of electric traction from every point of view. I may, therefore, claim to be reasonably familiar with the mathematics of electric railway engineering, theoretical and applied, good and bad. I believe I can say, as the result of my experience in the last ten years with students and teachers, with theory and with practice, in connection with electric railway engineering and problems, that electrical engineering has, to say the least, accomplished as much as any other branch of engineering in throwing light upon the mysteries, puzzles and problems of traction, and that it not only has pointed out but has led the way to better work, and especially better economy in many instances. The impression is that the electrical engineer is both abstruse and abstract, and too busy with his abstract mathematics to consider the important question of money and its paramount importance as the one factor which should be and must be ever kept in sight by everybody in all calculations in connection with any traction enterprise, whether steam or electric. I am going to show you that the electrical engineer not only does not forget financial considerations, but that he takes them into account at the very outset. As an illustration, I will state that for many years, in my lectures to students on the science and economics of electric traction, it has been my custom to present to them in the very first lecture devoted to the study of electric traction projects, an equation to which I have given the name of "equation of financial feasibility." It may seem rather far-fetched that an electrical engineer should begin by discussing the question of the almighty dollar, but it certainly shows that the electrical engineer does not forget the dollar and the importance of its role in connection with such projects. You will see that the electrical engineer understands how deeply one must go into things to get to the bottom. If algebra could teach us merely that, its use would be justified and vindicated by that result alone.

A complete discussion of this equation was given to me, in French, at the Electrical Congress held in Marseilles, France, in September, 1908, and will be found in the printed proceedings of this congress which have just been issued. The equation, though not previously published, has been used by me in my lectures for about eight years, and has been given, together with a brief discussion, in the mimeographed notes of my lectures. It looks extremely simple but it means a lot, as we shall see presently:

$$(R\text{-}E)/c=100—F$$

The total gross receipts (R), less the total expenditures (E), divided by the capital invested (C), multiplied by 100, gives a factor, F, which is the "figure of financial merit." The equation can be used without the factor 100, but in that case the value of F would be a decimal. By multiplying by 100 we get a round number instead of a decimal. For instance, six and a half per cent can be expressed by the decimal 0.065, but it is usually more convenient to express it by a round figure for the per cent, thus: 6.5 per cent. The figure F really represents a per cent value expressed in round numbers. That equation looks extremely simple, as already said, but it is the head-line and the epitome of a discussion of railway science and economics, in general, which may well occupy the time of from fifteen to twenty lecture hours. I can only refer briefly, now, to its usefulness and significance. To begin with, the numerator, i. e., receipts less expenditures (R—E), symbolizes the important point, which, it may fairly be claimed, was first noted by the electrical engineer, namely, the fact that it is not necessary to reduce the cost of operation in order to increase the financial returns of a road. This simple expression conveys a moral, which, so far as I know, was first taught by the electrical engineer, in the days when electric traction first began to supplant horse-traction in street railroad work. It is there that the electrical engineer had a chance to learn and to establish the fact that though he may not always decrease the cost of operation, yet he may accomplish the same results by increasing the receipts, for you have probably discovered by this time that the quantity (R—E) means substantially the *net* receipts. This expression shows very clearly that it is the *difference* between receipts and expenditures, rather than the absolute value of either receipts or

expenditures, which is going to be of importance as a factor in determining the value of F.

Now, the receipts themselves, though symbolized by a single letter here, may be decomposed or subdivided into various subsidiary amounts, which we will, for convenience, designate by special symbols. The expenditures may likewise be decomposed into various subsidiary amounts, which may also be designated by subscript letters. Likewise the capital C may also be decomposed into various amounts, as we shall see. Let us note here that the quantity C does not necessarily represent the capital actually invested. It represents the amount of capital on which a return is expected by the capitalists. We shall see, presently, that these two things are not necessarily the same, and may, indeed, be quite different. If we decompose the first of these three quantities we have:

$$R=R'+R''=R'''+\text{etc.}$$

Thus, in this case, R' may equal receipts from passenger traffic, R'' receipts from freight traffic, R''' receipts from rental or lease of property, etc. In regard to the total expenditures (E), they may generally be classified under two heads, known technically as the fixed charges and operating expenses. Thus, we have:

$$E=Ef+Eo$$

The fixed charges Ef represent those items which do not vary with the industrial output of the project, that is to say, with the amount of business done by this concern. These items include interest on stock and bonds, taxes, insurance, sinking fund, administrative salaries and expenses. The quantity Eo represents labor, fuel, repairs, supplies, etc. Of course, this quantity can be further subdivided, if desired. For instance, it is generally desirable to separate repairs, maintenance and depreciation from the rest of the disbursements. The quantity Ef will generally amount to a certain total percentage, which can be expressed in terms of so much per cent on the total capital invested in equipment. This figure is seldom lower than 12 per cent, is usually 14 to 18 per cent, and sometimes as much as 20 per cent, or even more, of the capital invested in equipment.

With regard to C, I usually decompose it into subsidiary quantities, as follows:

$$C=Ce+C1+Cw+Cg+C'+C''+\text{etc.}$$

In the subdivision of C the quantity Ce represents the capital actually necessary for and expended on equipment. The quantity C1 generally represents legal and other expenses pertaining to the organization of a company, the procuring of rights-of-way, terminal property, etc. The quantity Cw is one of great importance, especially in America. It represents the "water in the stock." There is also another quantity of similar character, namely, Cg, which is sometimes put into represent the amount of graft which the enterprise must reckon with. Sometimes the water and the graft are put in the same item. C' C'' may represent still other kinds of capital.

The question how good or how bad a project is can be answered by the value obtained for F, by the engineer, when the quantity C is restricted to the quantity Ce alone; that is to say, when we leave out water, graft and other like considerations. Under such conditions the project will be considered not bad, when we find a value F=10; pretty good, with a value of F varying from 12 to 15; good, with a value of F varying from 20 to 25; very good, with a value of F varying from 30 to 50; splendid, with a value of F varying from 55 to 75; magnificent, with a value of F varying from 80 to 100, and so on.

Ideas naturally vary greatly in regard to the scale indicated by a *thermometer of promotion* of this character. The promoter would be inclined to make the scale values lower than the capitalist; thus, the promoter would consider a project magnificent if it showed a value of F=20, whereas the capitalist would not show fever heat unless the value of F is three or five times greater. The value of F in such cases shows how much margin there is for water and other incidentals. If the value be F=10, without the water, it is obvious that by adding water equal in amount to Ce the value of F in the total quantity C=Ce+Cw will give F=5; that is to say, the project will pay 5 per cent on a certain amount of bonds representing actual money, and an equal amount on stock representing merely water, etc.

You will see, therefore, that the equation is sufficiently comprehensive to cover and epitomize pretty nearly everything that goes into an enterprise or comes out of it. This equation is the best and most impressive way of telling any student of traction and transportation problems, whether he be young or old, what he is liable to run up against and what he must look out for, not only in a technical way, but also in a financial way.

This elementary discussion of our equation of financial feasibility suffices to show the fundamental factors which enter into and govern the financial arrangements and results of a traction project, whether it be one employing steam, electric or any other motive power. A further consideration of this equation leads us into a wide field of study. In my lectures to students I endeavor to impress upon their minds that all problems in transportation, by any motive power whatever, and all solutions and methods of solutions are only details of the solution of this equation. I then show them that to go into the details fully they must cover practically the whole field of engineering and economics. In connection with the receipts, for instance, we have to consider everything which influences them or may improve them. Of course, the detailed study of this particular factor of the problem may not be so much in the province of the engineer as in that of the statistician, or transportation expert, but nevertheless the engineer must and should know its paramount importance as the meat and core of the situation. When we come to consider the cost of operation in detail, we have to consider the quality of the plant, also the personnel, the train schedules, the methods of operation, and in fact every possible thing capable of influencing or affecting this cost of operation. The student has to learn, for instance, that the quality of the plant and equipment influences and affects the ultimate financial results by changing both the fixed charges and the operating expenses, though it may do so in a peculiar manner. If the plant and equipment are of high grade and quality they will cost more, and, therefore, the fixed charges will be increased, because more money must be expended in procuring them, and consequently, more interest must be earned by them. On the other hand, the operating expenses may be and usually are decreased. It requires, of course, a very close study and close investigation, and much care, skill and experience, to determine where to draw the line, and what quality of plant to select for each particular case. Our equation enables us readily to foresee, even, and to predetermine, the financial consequences and results of anything that the engineers may do or fail to do in designing the equipment. It keeps before the student of transportation problems the important fact that everything that is done rightly or wrongly has a money significance and value to the financier. An electrical engineer who does his work conscientiously is trying to get the highest possible value for F, and while he must put in enough reserve, he must avoid putting in too much capacity, thereby increasing the capital cost and fixed charges. He must weigh carefully the chances of financial loss, resulting from a plant costing too much and having a low load-factor on one hand, and the chances of losses, interruptions, breakdowns and expensive repairs and maintenance, due to a

plant having too small a capacity and reserve, on the other hand. In the case of an electric traction project, it will be necessary in order to determine the capacity and quality of the plant and equipment, to make a more or less comprehensive and exhaustive study of the operation of each kind of train and its power and energy consumption on various grades and curves and at various loads and speeds. In order to solve this equation the student finds himself compelled either to make a study of statistics relative to the operation of comparable existing trains, when such statistics exist, or else to pre-determine the results by certain methods, based upon and involving the use of speed-time, power-time and energy-time curves and the other subsidiary curves derivable from them. In this connection the electrical engineer can point with pride to the great advance made, through his efforts and his mathematics, in the scientific study of train-motion, train-power and train-energy. The methods of predetermination of train-power, train-energy, etc., based upon the use of speed-time, power-time and energy-time curves, were a great step of progress in the science of train movement, for which the whole credit belongs to the electrical engineer. These methods were the results of the intelligent use of algebra and mathematics, the same as many other methods, equally valuable, devised by electrical engineers. He can point with pride to the practical results which he has already obtained in so many directions by the intelligent use of mathematics, and he can challenge the rest of the world to do as much before criticising him.

The equation of financial feasibility is, as you see, a splendid algebraic way of assembling together all the factors, and putting them before our eyes in a manner that will enable us to get correct notions of the true perspective, and the true relations of the various factors to each other. The mathematics used by electrical engineers in finding the details of the solution of this equation are not necessarily complicated or abstruse, or misleading, though I regret to say they have been often misunderstood. They have won out, however, and they will continue to do so.

I trust that I have gone far enough to show you that we base our work on mathematics and use mathematical expressions, and yet do so intelligently, and not at all in the manner criticised in the editorial. The intelligent electrical engineer uses mathematics whenever he can do so to advantage. I have endeavored to show you that we do occasionally do so in such a way as to throw more light on traction problems than can be thrown upon them by less elaborate but less lucid methods.

Mr. Wm. McClellan—As usual, Mr. Stillwell's remarks show comprehensive observation and I cannot help but emphasize a few of them. He asserts very reasonably that the electrical engineer should approach steam railroad electrification with the same confidence that he approached subway, elevated and interurban work; and that the same sort of careful analysis applied to proper data in the way that this was done for lighter electric service will prove, beyond a doubt, that electrification is possible and advisable along heavier lines.

His suggestion as to the management of railroads' considering the promotion of parallel electric lines for local service is of the utmost importance. His statement that the electrical engineer who carefully studies transportation problems should be of equal rank with the railroad man who makes a thorough study of electricity cannot be challenged.

Mr. Murray has had to make as close a study of the various systems of electrification as any living engineer and his knowledge of the two prominent systems in use in this country is therefore most comprehensive. This study and the excellent opportunity which he has had to verify his conclusions have given him a great faith in the single phase system and he makes his remarkes from this standpoint.

It should be clearly understood, however, what this committee report is. Some of the members of the committee may have equal faith in the single phase system with Mr. Murray, and others may have as firm a faith in other systems. The report, however, cannot show the extremes to which the various members would go if speaking as individuals. It must show the length that they can go together, allowing them to say as individuals how far they would go. The report is also important for showing the possibilities of electrification irrespective of system, and positively removes the idea that any particular system is a failure.

By "trunk lines" the committee always had in mind the popular definition of the term—lines between large cities having important terminals and a mixture of light and heavy passenger and freight traffic.

Mr. Murray's point in regard to electrification for passenger traffic and suburban service being more or less unsettled as to method is probably well taken and what is meant is terminal services only. His point about the ample current carrying capacity of the high potential single phase system due to mechanical considerations is also well taken. This, however, is an advantageous feature of this system and does not apply to the low potential direct current system. His criticism of the contingent costs is somewhat misleading. The committee did not mean that this was wasted money but merely that those who financed the electrification would have to take these costs into consideration because in many cases this would not be done except at the time of electrification although they might be valuable under any conditions.

Perhaps if third rail is not used, few changes would have to be made in bridges; but if it is used, there are many cases where important and expensive changes would have to be made in clearances.

Coal, wood, and water stations are not inexpensive items as I know from careful investigation.

Perhaps interruption of service and damage costs have not been serious in Mr. Murray's experience, but this good fortune does not always obtain.

Speaking now as an electrical engineer, let me say that I think that the report places the advantages of electrification irrespective of system clearly before the railroad world. I think that it shows clearly that confidence may be placed in the ability of several sysems of electrification, to accomplish the results desired. That one of these systems will eventually prove better than the others, can be asserted quite positively.

The report shows also that if the conditions are absolutely fixed, the question of system is quickly decided and that the question of proper system is somewhat uncertain only when the conditions are uncertain. Even then, however, there need be no apprehension that the system advised by any reputable engineer will not be thoroughly reliable and efficient.

Mr. Murray—As to Mr. McClellan's remarks I can only apply them as they deserve to be applied and I desire to say that Mr. McClellan has made clearer to me, what was somewhat clear before; viz: the duties that were placed upon the shoulders of the committee. I have tried to be very specific in regard to my definition of the trunk line and qualified all my remarks upon the basis of that definition. I thought it advisable to cite the experiences of a perfectly concrete case and it is in consideration of the remarks that I made this evening that I would like to have it understood that I did have in mind the N. Y., N. H. & H. electrification, which bears a close similarity to the kind of trunk lines I have defined.

(Contributed by Mr. Sprague)

The report concerns itself only with terminal and trunk line operation, despite the fact that many steam roads are

interested in interurban work, and the further important fact that every electrical development affecting the larger problems must find its precedent or basis in the smaller ones. It would have seemed proper—and I doubt not that the information would have proved interesting—to have noted the progress along interurban lines,—the application, for example, of single phase operation, the results attending its introduction, the reasons for its occasional abandonment, the development of higher potential direct current motors, the probable limits of such, and so on.

The difference between interurban lines and some so-called trunk lines lies often more in the size and operative character of the units and less in the density of traffic. Many such interurban lines are as long as the engine runs on a trunk line division, some are on private rights of way, and some join cities of importance, while both the train and car density on certain trunk line divisions is greater than on many interurban lines. The essential difference is that on one there is a concentration of cars into train units, and locomotive operation is an essential of through passenger and freight work.

In the so-called—and unfortunately called—battle of systems, various advocates attempt to classify railroad service, holding that while one system is all right and possibly preferable for such portion of the service as may be included in suburban zones extending 30 to 40 miles away from the termini, some other system may be, or is, necessarily preferable where the connecting link and through service is considered. The report itself lends countenance to this view when it says that "there is no difficulty in selecting a system for either a purely local situation or for an extended electrification, but the difficulty arises when a comparatively small zone must be electrified, and a system designed which can be economically extended later."

While generally admissible, this statement insofar as it infers that a system which may be satisfactory for a local situation is necessarily not a system which would be chosen for an extended system, is one to which I must take decided exception. If the statement is made with a knowledge only of the limitations of early standards in view, there is some justification for the inference, but with such knowledge as I have of existing and pending developments, and as derived from the results of a long study of as serious a railroad pr tem as exists in this country, I must emphatically state that the decision of what should be used on an existing division not complicated by any city terminal conditions is not a simple one, various assertions to the contrary notwithstanding.

What the future may determine on this question I will not at the moment hazard any prediction, except that it is well for enthusiasts to avoid too positive statements. The art is progressing. Direct current is working to higher possibilities, much simplified where locomotive operation alone is considered; alternating current motors are finding their limitations, and the relative motor equipments, potentials and capacities will in the near future be pretty well defined; then the doctors can settle down to the study of the specific problems in hand with the somewhat greater certainty, if the problems are approached soberly and with a desire to get at the facts and possibilities, of arriving at definite and satisfactory solutions.

Among the developments which are taking place, I may point out for the first time publicly that certain advances recently made now make it possible to operate at low potentials in terminal and freight yards, and much higher potentials on the main line, when using direct current, and to go freely from one to the other zone of operation with the same equipment with entire safety and facility. This result involves some developments with which I am sure the committee is not familiar. They help solve some of the problems which have been worrying those who have been studying terminal and freight possibilities in connection with main line operation, and while they do not necessarily determine what is the best method of operation, they at least give another tool for the electrical engineer and the steam railroad man to work with.

The committee reports that there is no overhead development which is satisfactory, and that thus far the third rail does not lend itself to satisfactory freight yard operation. If by this is meant that there is no overhead line which will not somewhat obstruct the view of the heavens, and no third rail installed which is not an additional burden to the roadbed, the committee's assertion is understandable, but if it is implied that a properly protected third rail which will permit the safe handling and making up of train cannot be installed in a freight yard without impossible limitations, and without any overhead structure in connection with it, I take exception to that statement. Equally is it open to criticism to say that an overhead system cannot be installed which will permit in a yard practical freedom in the make-up of freight trains.

The railway world may as well accept the inevitable so far as some matters are concerned. Every important terminal will of necessity be electrified in the comparatively near future, and the problem is how can this be accomplished in great cities with the minimum of burden on the railroads, and the maximum of benefit to themselves and the public.

Intimately connected with this question is another, whether electrification shall proceed from in out, or from out in—from zones of congested traffic where many benefits besides economy may accrue, and where the necessary trend of progress will dictate electrification, or from the sections of less dense traffic and less urgent need, where economy of operation alone is of greater relative importance. I think it safe to say that from the hub out will prove the rule.

The terminal problems of cities, like, say, Chicago, should be considered without prejudice by a board of engineers representing both the city and the railroads. When termini can be consolidated certain advantages are manifest, but it should be borne in mind that even where such phpsical unification of track facilities is impracticable, consolidation of electrical supply is both practical and advisable. Independent power houses for each railroad terminal should be discouraged; they should receive their supply from great common power houses either owned and operated on a community plan or conducted as an independent enterprise. In such way the individual and the total costs can be enormously lessened and the problems of electrification minimized.

It is regrettable that the committee has found such extreme reluctance on the part of officials to permit the publication of facts concerning equipment and operation, on the ground that the time is not yet ripe or operation sufficiently extended to permit just comparisons between steam and electric operation.

Contrary to this policy of suppression of information I note that quite complete data concerning the operation of the Long Island and West Shore electric divisions have just been submitted to the International Railway Congress, and I know that the whole art will be benefited, and electrical engineers and operators will most quickly find a common ground of agreement if there is publication of the most complete facts as to the costs of installation and operation in such detail that thorough analyses can be made. There is no difficulty in connection with this save the objections raised on the part of railway officials, which only result in half truths being disseminated, and progress delayed in consequence thereof.

The committee has, I am glad to note, pointed out that while electrification is always attended with collateral expen-

ditures, all such that go to the general benefit of the road, and are not a necessary part of the actual electrification cost, should not be debited to it, even if carried out coincidently. It has been the fashion to do otherwise, to make electrification bear the burden of the enormous cost of much needed and delayed improvements in great terminals, when the truth is that the electrification proper has represented but a minor part of such costs—for example, on the New York Central 23 per cent and on the Pennsylvania about 22 per cent—has made other vital improvements possible, and has saved far more than their cost in the otherwise necessary carrying out of improvements for steam service which would have still left many problems unsettled.

SCARCITY OF GENUINE WHITE OAK TIMBER.

The U. S. Department of Agriculture reports that the so-called white oak timber of our markets is often a mixture not only of various species of the white oak group but also of other species, such as the red oak. Foresters divide all the oaks into two distinct groups—white oak and black oak. One distinction between the two is that the black oak requires two years to mature its acorns, the white oak but one. The woods of the two groups of oaks are also structurally different. The true white oak, known to botanists as *Quercus alba*, is merely one of the species which make up the white oak group. Red oak, on the other hand, belongs to the black oak group. Red oak has a number of other common names, among them mountain oak, black oak, and Spanish oak.

There is so much confusion in the ordinary use of the names of the oaks that it is almost impossible to keep them straight without resorting to the scientific terms. Red oak is now much more abundant than white oak, grows faster, and is generally regarded as inferior. The two species often grow together and occupy the same general region. In the early days of its abundance, market white oak was derived almost entirely, it is safe to say, from *Quercus alba*, the true white oak. This species combines approximately the utmost strength and toughness of any of the timber oaks, except possibly southern live oak, which in the colonial days was so highly prized for ship-building that it was protected by special laws. The immense inroads made upon the then apparently inexhaustible white oak forests, which stretched from the Atlantic seaboard nearly to Missouri, gradually so reduced the supply that the use of other species became inevitable.

At the present time it is almost impossible to obtain a consignment of white oak that does not contain pieces of some other species. Of the white oak group those most used, in addition to true white oak, are bur oak, chestnut oak, chinquapin oak, post oak, swamp white oak, cow oak, and overcup oak; of the black oak group, Texas red oak, red oak, and spotted or water oak.

Real white oak timber of number one quality is very largely cut into quarter-sawed boards, while a combination of one or more white oaks and red oak may constitute other cuts of "white oak." In many markets, the term "cabinet white oak" is now understood to include a mixture of white oak and red oak, and it often signifies red oak only. All the species of white oaks enumerated are distinct but closely related species, which together must be depended upon for the future supply. For the ordinary purposes for which true white oak is used, practically all the trees of this group yield woods that can be interchanged and will serve equally well.

FENCE POSTS IN IOWA.

The United States department of agriculture estimates that the farmers of Iowa use every year $1,400,000 worth of new fence posts, which cost about $600,000 for setting, and is of the opinion that a part of this expense might be saved. The opportunity for economy is found, first, in using the kinds of posts which, taking into account both cost and durability, are cheapest in the end and, second, by treating the posts to prevent decay. When a farmer sets a post which will have a comparatively short life, he loses not only through having to buy a new post but also because of the additional labor involved in setting it. It is true that in both cases no money outlay may be involved, for he may set the posts himself, after getting them from his own woodlot. Of the posts used last year in Iowa, it is estimated that only 30 per cent were bought from lumber dealers. Nevertheless, the farmer is out his labor and the part of the product of his woodlot which is used, even though no cash is paid out.

About 10,000,000 posts are required yearly to build and repair fences on 209,163 farms, of an average size of 158½ acres each. The average life of a fence post is said to be fourteen years and the average cost 13.7 cents. There is, however, great difference in the lasting properties of different woods. Osage orange lasts more than five times as long as willow does, and for length of service it heads the list of post timbers in Iowa. The comparative life of other posts is shown in the following list, ranging from the longest period to the shortest: red cedar, locust, white oak, northern white cedar (or arborvitae), catalpa, black walnut, butternut, different woods, and for the same woods in different places red oak and willow. The average cost of posts varies for Red cedar is most expensive, at an average of 26¾ cents, and willow the cheapest, at 6 cents.

Taking into consideration the time a post will last, and the cost of buying it and setting it in the ground, the conclusion must be drawn that the osage orange post is the most economical in Iowa, followed by white oak, locust, catalpa, red cedar, black walnut, butternut, willow, white cedar and red oak, in the order named. Comparatively few posts of some of these woods are used. Catalpa and butternut together do not constitute 1 per cent, while white oak exceeds 40 per cent. From white oak, the highest, the numbers used range down in the following order: white cedar, osage orange, red cedar, willow, black walnut, locust, butternut and catalpa. A few posts are cut from other woods. Nearly or quite one-half of all the posts are round, indicating that most of the trees cut were too small to split.

The low place attained by black walnut and butternut, generally rated high in lasting properties, is probably due to the fact that the posts were round and small, and therefore largely sapwood, which decays quickly. The life of such posts would be much extended by giving them preservative treatment. Preservative treatment increases the life of all wooden posts and more than doubles the period of usefulness of those which are mostly sapwood. The two million dollars spent yearly by Iowa farmers in buying and setting fence posts might be materially lessened by putting into practice the well-known methods of wood preservation. It costs much less to treat a post than to buy a new one and set it in the ground, and in addition much wood could be saved for other purposes. The department of Agriculture has made a special study of practical methods of preserving farm timbers, so that it is able to inform interested inquirers how to do this for themselves.

On Monday, August 29, 1910, the general offices of the Rail Joint Co. were moved to the Cameron building, 185 Madison avenue, New York city.

We take pleasure in complimenting the Traveling Engineers' association on the very complimentary notices of its recent meeting which have appeared in other journals. It was nothing more than the association deserves, as it is one of the lively organizations of the present day, and is worthy of all praise on account of the hard and painstaking work that it is doing.

The Maintenance of Way Department

Editor, Railway Engineering:

I have never found any better method of keeping switches clear of snow and ice than to have a catch basin in close proximity to a switch, so that the water from the melting snow will drain away instead of freezing. These catch basins should be kept open by using a plentiful quantity of salt. I have never used anything except shovel and broom for keeping switches cleaned out during snow storms and I doubt if there is anything more effective.

Massachusetts. Roadmaster.

Editor, Railway Engineering:

The section and yard men must look to the clearing of snow from yards, switches, frogs, cattle guards, etc. Extra gangs will often be required in heavy snow storms, especially at passenger terminals. Yards should be kept well drained, so that after a thaw there will be less standing water to freeze. The trenches in which connecting and switch rods work should be kept open to prevent accumulation of water. Salt should be freely used in clearing ice and snow from switches and frogs, and light, drifting snow swept out. Slide plates should be kept oiled to prevent their rusting from using the salt, which will make the switch work hard. I have found it very convenient to set stakes near switches and hang brooms, where switchmen may readily get them to sweep out from around the points. The Boston & Maine has a special car on which a heavy cutter blade breaks up the ice, and a scraper blade or flanger behind cleans away the loose ice. The blades can be raised and lowered by levers or air cylinders. A track sweeper with revolving brooms (as used on street railways) has been used in some large yards. Weed-burning machines may also be used in cleaning yards and interlocking plants. The Boston & Maine has experimented with oil and gas heaters placed at switches in busy passenger yards connected with a pipe system. The snow is melted as it falls, so that there is no large accumulation to cause trouble. The system keeps the ground warm, so that it is not frozen and can absorb the melted snow.

On interurban lines the regular cars may be fitted with pilot plows, scrapers and flangers, and work cars fitted with nose plows and side leveling boards. Large wing plows of the Russell type are sometimes used, and a few lines have the rotary. These are similar to the rotary used on steam lines. Track sweepers and spreaders are also used in streets. Salt is sometimes used at frogs and switches. If used too freely it is liable to cause trouble with the electrical apparatus, and it is objected to in some cities, as it makes a slushy mixture, injurious to public health and affecting the hoofs of horses. On elevated railways scrapers and wire brushes on the cars (or handled by track men) are usually employed to clean the third rail, and sometimes there are special cars with rattan brushes to clean snow from between the guard timbers.

California. Roadmaster.

Editor, Railway Engineering:

Below please find a brief report of my opinion on drainage, which I trust may be of some benefit to you.

Ditching.

Good drainage is one of the most essential features of good track. All water which falls upon the road-bed or adjoining land should be conducted through ditches, culverts, bridges or other channels to the nearest running stream that will take it away beyond possibility of injuring the track.

Local conditions should govern the method of drainage at different places. Where ditches of sufficient depth can not be maintained, tile should be used. In cuts where the soft condition of the road-bed prevents good surface of the track during the summer and causes the track to heave in cold weather, tile should be laid at a sufficient depth to be at least below the frost line; tile should be carefully laid and should not be less than 3 feet below base of rail. Where spots of quicksand may be encountered or other very soft ground, locomotive cinders should be used under the tile because the clay or quicksand will not mix with them, as it would with other material, and this will prevent the line of tile from being disturbed. Where the soft spots exist in the road-bed cross trenches should be dug and tile laid from the main tile across the track at the middle of all such places, and the location of each cross drain should be marked by driving a stake in the side of the bank. Care should be taken to know that tile has sufficient fall. If measurements cannot be made by the foreman to determine, grade stakes should be set. Tile should first be covered with 4 inches of hay or straw, after which the filling should be completed with locomotive cinders. The outlet from drain tile should at all times be kept open to insure a free passge for the water coming through the tile, otherwise material may accumulate and block the tile.

The elimination of soft spots is of prime importance in securing that degree of perfection in surface and line of track necessary for safety under present conditions of high speed and heavy wheel loads. At other places open ditches properly constructed should be maintained in cuts, the bottom of ditches should be carried alongside of the tracks and not less than 10 feet from the rails on each side, they should be as far below the bottom of the ties as it is possible to have them, and retain a nicely proportioned incline from the ends of the ties to the back of the ditch. Open ditches when too close to the track, cannot well be maintained to the proper depth. Where water is standing in borrow pits or elsewhere the right-of-way ditches should be constructed to carry off the water to an outlet.

Ditches should be maintained, if possible, 15 feet from the embankment and the material excavated should be deposited in a uniform manner along the toe of the embankment; this will strengthen the embankment and prevent sliding.

Open ditches should be constructed where it is possible to do so on the top of cuts to prevent water from running over the face to the track. To prevent slides in cuts, I have found that by excavating perpendicularly and also in some ploces horizontally and putting in heavy trenches of stone that it has arrested sliding. In addition to doing this I have sodded the face of cuts and driven stakes 3 feet long through the sod along the face of the bank. I find that using stakes freely to be an excellent thing to prevent sliding.

Ontario. Roadmaster.

Editor, Railway Engineering:

With reference to the best methods of keeping switches clear of snow and ice: Drain your switches wherever it is possible; keep dirt and all obstructions from under them to the depth of four or five inches; this will give your switches a chance in case of snow and water before the space is filled. Station men at all switches during snow storms and keep them swept but so as to keep them in order. We use salt in all switches except at interlockings. If the storm is too heavy to keep them open with men we take an engine and hose and steam them out. This is the last resort, on account of

the expense. But we don't steam out switches with an engine except at interlocking plants. These switches must be kept in service at all times.

Illinois. Roadmaster.

Editor, Railway Engineering.

We only employ one method here for keeping switches clear of snow and ice, that of removing whatever materials are between the ties to the bottom thereof under switch points and spring rail frogs, so as to make a space for snow, and for the convenience of removing it readily. We then try to keep the snow leveled off as much below the rails as possible in the vicinity of switches to avoid drifting. We also use salt which is a good thing to keep points and spring rail frogs free from snow.

Wisconsin. Roadmaster.

THE ROADMASTERS' CONVENTION.

The 28th annual convention of the Roadmasters' and Maintenance of Way Association was held at the Great Northern Hotel, Chicago, on Tuesday, Wednesday and Thursday, Sept. 13-15. The convention was called to order at 11 a. m. on Tuesday by President James Sweeney, roadmaster, Chicago & Eastern Illinois.

President's Address.

"Once more in the life of our association we are about to hold our convention in the city of Chicago. To me it seems the ideal meeting-place for men who are actively engaged in the very groundwork of railroad activity. There are but two centers of railroad life in this country, and they are Chicago and New York. The latter is the money center, a place well fitted for the holding of directors' meetings, while in Chicago we have the railroads themselves, with all their generals of operation. In New York policies are mapped out, but in Chicago they are carried out.

"To a large percentage of us this city is our railroad's headquarters; the far-off point from which the pay car used to start, the point where the checks are now made out, and any place where I am close to the check-making department is home to me. Evidently Chicago is glad to see us adopt this as a temporary home, for she has to-day sent to welcome us a man prominent in the life of the city.

"We are entering the twenty-eighth year of the life of our association. Like many other organizations our beginning was humble, but each year has added something to our growth. This year I understand that through the efforts of our secretary and individual members working in harmony with him we are to add more than 100 new members to our roll. This does not mean simply one hundred men; it means three times the number of new members that joined our ranks last year, three times the effort put forth by the members of this association in any previous year. I hope we may continue with the magical number three and have a meeting this year three times as successful as we had last year, and not overlook the fact that all work and no play is not good for these boys and girls of yesterday.

Last year we were favored with committee reports that were far above anything to be expected of committees who had not been permitted to meet at regular intervals, and where the individual members had had only limited time to devote to committee work. This year many of the same men are members of our committees and I anticipate better reports than we had last year. In this connection I wish especially to urge the younger members of the association to take an active part in discussion of any questions that may arise and to ask them to be prepared to act as members of committees for the coming year.

"You younger members perhaps realize the importance of your duties in your positions as roadmasters more than the older members. I can recall quite clearly the nights when I worried over railroad problems, for several years after I had been given a district, and the trains were not so heavy then as they are now. If I had only thought so then, almost any kind of track would have answered the purpose of keeping the little engines and two or three imitation coaches on the track; for there were no fast freights or limited trains then, and no tracks in fit condition to run them on if we had them. The rail was 56 pounds to the yard, and the joints were made with fish plates.

"Historically, the fish plate was the next joint after the rail chair. You who have blamed some old-time foreman because you have found a pair of fish plates on a side-track in some out-of-the-way place should have seen a piece of main track laid on a grade with rail chairs. An English writer on the subject of rail and rail joints about the time that fish plates came into use says that there was great objection to the rail chair on account of the contraction and expansion of the metal, causing the rail to pull out of the chair. In some cases the movement of the wheels had been known to cause the ends of the rails to fly up and protrude through the floor of the car, causing the passengers great discomfort. I can recall these ends of rails sticking up out of the chair myself, but it was my good fortune never to see any of them getting up into the coaches. We called them 'snake heads,' and whenever we found one it was our first duty to drive the rail back and get it properly placed in the slot in the rail chair. But the introduction of fish plates stopped all that, and one of our then greatest worries was over.

"You younger members have not had to worry over such problems as 'snake heads' and fish plates (which we know now are about as bad as anything could be), but you have come into this line of work at a time when the question that confronts you is how to keep heavy, fast-moving trains on heavy, well-ballasted track. Your problems are big and you have never thought of the trifling things we older men have grown gray over. On the other hand, we have grown up fighting the little things in railroad work, and we are too prone to keep on fighting them after the battle is over. It is your mission to bring into this association the discussion and solution of the weightier questions of the track department, and we are waiting to hear from you in this year's proceedings and in the proceedings of the association in the years to come.

"Just one more word to the young men, especially, but you may all consider it. At former meetings we have touched upon the subject of advancement for roadmasters. I have given the subject much thought and to me it seems that any fault that may be found lies mostly in ourselves. I believe that any man who is competent to handle a roadmaster's district under present conditions is able to make an engineer of himself, and I leave it to you whether an official casting about for men to promote would pass by a man who had become practical first and technical afterwards In the years to come I hope I may see many of you pass on up the ladder of promotion more by your own endeavor and ability than by fortunate circumstances."

Following this secretary W. E. Emery presented the names of 114 candidates for membership, all of whom were elected. This large list of new members was received with many expressions of appreciation of the work of Mr. Emery, and ended with a vote of thanks to him for his enterprising efforts to increase the membership.

The address of welcome was by Mr. Geo. M. Bagby, assistant corporation counsel, of Chicago. He said, among other things, that by reason of its many railway connections, Chicago was no doubt the ideal convention city of the United States. While many things now to be seen there by visit-

ors were of very practical interest there was in prospect a "City Beautiful," which, when realized, would make the place a center of attractiveness worth coming a long way to see. Plans were already laid by which Chicago would emulate Paris in art and beauty, and Paris had found that money spent for such purposes was a good investment. Chicago, in his opinion, was destined to become the "Paris of America."

Care of Track Material and Tools.

The convention next took up the committee report on proper care of track material and tools which follows:

Untreated Track Ties.

Cross ties, when received in rude form direct from the forest, are to be stored in material yards or distributed on the roadmaster's subdivision. As soon as unloaded, they should be piled—suitable high ground with good drainage having been selected for this purpose. Two old ties or timbers should be placed next the ground as a foundation for the pile, which should be composed of cross tiers with no more than six or seven ties in each tier—the size of the ties to govern—but plenty of space should be allowed between the tiers to permit them to dry out and thoroughly season before being placed in the roadbed. The ties in the last tier should be placed close together, to act as a roof over the pile, and should have a pitch of about 6 ins., which can be accomplished by placing two ties under one side of the top tier and one tie under the other side. This last tier should slant away from the track.

If the ties are unloaded along sections, the number of ties in each pile would depend upon the number of ties per mile required for renewals. If the ties required per mile should be from two to three hundred, we would pile from 25 to 40 ties in a pile; if the tie renewals should be light—say, from 75 to 100 per mile—we would pile them in V-shaped piles of about 15 ties each, so that the track men would not have to haul them too far on the dump car in distributing them.

The sod should be removed from around the piles for a space of at least 6 ft., and the grass should be mowed from the grass line to the edge of the right of way at least 50 ft. on each side of the piles, to prevent fire from getting into them. In piling untreated ties of all kinds they should be placed with the heart side down, and in placing them in the track the heart side should always be placed next to the roadbed. The accompanying sketch will show the manner we would recommend for piling and placing in the track.

Treated Track Ties

Ties treated with solutions of zinc or chloride should be piled in cross tiers, similar to untreated ties, and as openly as possible, in order to bring about rapid evaporation of moisture from the ties before they are placed in the track. We believe in the theory advanced that the zinc chloride used in treating the zinc ties is an antiseptic and being forced into the tie renders it impervious to all animal or vegetable life which is the cause of all wood decay. Consequently, the drier the wood becomes, after treating, the more thoroughly the wood becomes impregnated with the zinc chloride.

Now, zinc chloride, when pure, is practically insoluble in water, and if the chloride could be introduced into the tie in an absolutely pure state the effect of the tie being wet by rains while in track would be practically nothing. It does not get into the tie in a pure state, however, and the result is that the continual soaking and drying of the tie in the track does, eventually, wash out the chemical, and as it wastes away the various small animals and fungi find feeding ground in the outer surface of the tie, which we then say has begun to decay. This washing away of the chemical treatment, be it either zinc chloride or the other processes of a similar nature, can be very materially reduced by proper ballast and a well drained roadbed.

Ties treated with creosote should be piled in just the opposite manner from those treated with zinc chloride. They should be placed in cross tiers, but just as compactly as possible, so as to leave no air spaces between them. The reason for this is that the creosote disappears with some rapidity from the creosoted ties, and every precaution must be taken to reduce the rate of evaporation.

On the other hand, the process of treating creosoted ties is done along another line, in that the pores of the wood are filled with creosote oil. In treating these ties, the oil is forced into the wood as thoroughly as possible, rendering the tie waterproof. So long as the creosote oil remains in the tie it will also keep out any animal or vegetable growth and prevent decay. But all oils are to a certain extent volatile. Creosote oil is not an exception to this rule, but evaporates rather rapidly for a heavy oil. This can be noticed when a pile of ties is examined at the time of unloading and at a later date, say, 30 days, 60 days and 90 days after. When first received, the tie is very wet with oil, but later it becomes dry enough to be handled without soiling the hands and the color will have changed from black to a dark brown. This is the case with ties when piled in an open pile or with the outside ties in a compact pile, while the inside ties will still be black and will be almost as oily as when unloaded. This outside oil has not been absorbed by the ties, since the oil was on the tie when it left the treating plant where the pressure is very great and the temperature is raised to a point where the pores of the wood will best admit the oil.

Since we know that creosote oil does evaporate and that the principle involved in this method of treating is to effectually seal the pores of the tie against the admission of water and air with their load of wood-destroying germs, we easily arrive at the conclusion that the better method is to get the creosoted ties into the track as soon after treating as possible, but in the event that this is impossible, as it usually is in the majority of cases, we would then use the best method we could to stop evaporation by piling them close together. We would go a step further in the method of piling these ties and would recommend that a layer of fresh earth be placed over the top of the piles which would serve not only as a protection against sparks from passing locomotives, but would also be an additional measure of precaution to retard the evaporation of the creosote oils.

Switch Ties and Head Blocks.

When switch ties and head blocks are received they should be distributed at once to the sections where needed and should receive the same good care in piling as is given to track ties. Old ties or timbers should form the foundation, and they should be piled in tiers, with a 2 or 3 in. strip between the tiers. Sufficient space should be left between the tiers or head blocks to permit them to dry out well and thoroughly season before being placed in the track, and where a great quantity of this material is piled in supply yards, we would recommend that the different lengths be piled separately, to avoid confusion in loading them up for distribution.

Crossing Plank and Fence Lumber.

This material should be piled the same as switch ties, in tiers with at least a 2-in. strip between. Different lengths of planks should be piled separately, to avoid confusion and unnecessary handling when taking them for use. We would recommend that this class of material be ordered once a year and used as soon as possible, after it has been well seasoned, except a small surplus, which may be kept at division headquarters for emergency use.

Rail.

New and usable rail should receive great care in the unloading, to prevent it being bent or broken; and in piling great care should be taken in forming the foundation, which should be composed of old timbers. The foundation would

depend upon the size of the pile, but in all cases it should be strong enough to prevent the rail from becoming surface bent while in the pile. Rail should be piled in tiers, and rails of equal length should be placed across each tier to form the sub-foundation of the next tier. The number of rails to be placed across the pile would depend upon the length of the rail in the pile and the number of tiers the pile contains, but not more than 8 ft. space should be left between rails placed across the pile.

Switch Material.

When switches or frogs or guard rails are kept in stock, they should be piled on skids or rail rests. Ordinarily this kind of material should not be distributed along sections, but a sufficient amount of each kind, of the same pattern and weight as the rail in the track, should be kept at division headquarters or in the larger yards, where it may be quickly secured when needed. Each kind and pattern should be sparated to avoid confusion in loading it when called for. When railroad crossings, frogs or switches are kept in stock for any length of time, we would recommend they receive a coat of cheap dark paint and the bolts be well oiled to prevent rusting.

Rail and Joint Fastenings.

A small supply of joint fastenings, spikes, bolts and nut-locks should be given each section, which should be kept under cover in the tool house or under a roof, where it will not become rusty. At division headquarters or the larger yards where it is necessary to carry a large amount of this material in stock, if no permanent shed is provided, it should be neatly piled up and a temporary roof of old boards should be placed over the same. Track bolts should be closely watched and if necessary a little cheap oil be applied to prevent rusting.

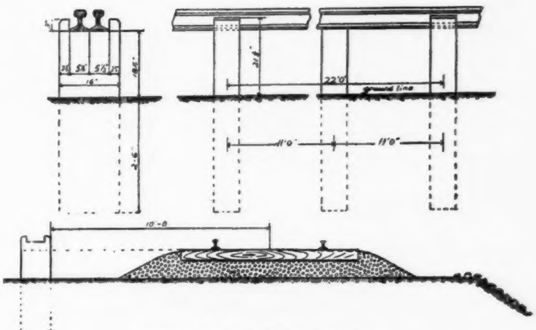
Emergency Rail.

Each section should have a sufficient amount of emergency rail on hand to answer the purpose for which it was intended, which will be governed to a large extent by the condition of the rail in track. If the rail is in good, healthy condition, one emergency rail each two miles will be sufficient for single track. One pair of emergency angle bars should also be placed with each rail. These rails should be placed on suitable rail rests at or near mile posts. The rail rest shown by the accompanying sketch we would recommend for this purpose.

Tools.

Each section should be supplied with a sufficient number of first-class tools, the very best that money can buy, as there is no greater waste of money than for section crew to work with inferior tools. The number of each kind would be governed by the number of men in each crew. In addition, each section should have a few extra tools for use in case of emergency, but no more than is absolutely necessary to properly care for the work. A monthly inventory of all tools on a section should be rendered by the section foreman. In general, for ordinary repair work, the foreman should make his requisition on the roadmaster for tools and material once every thirty days, and the foreman should be furnished with a small surplus of tools and material blanks on which he should enter all tools on his section which will not be used for the next thirty days. This blank should be pinned to his monthly requisition and forwarded to the roadmaster at the close of each month. This will enable the roadmaster to transfer tools and material from one section to another and thereby avoid making requisition for supplies which he has on his division available for use. A great deal of money can be saved each month by having a system of this kind or a similar one. All tools as soon as they become dull or out of repair, so they will not do first-class work, should immediately be sent to the shops for repairs, and they should be put in good shape and returned to the section from whence they came without delay.

The hand car with a section crew should be the very best that can be obtained. It should be as light as possible, but sufficiently strong to carry six or eight men and the necessary outfit of tools. There is no greater waste of money than to have a section crew running a poor hand car; thirty minutes lost in the morning and thirty minutes in the evening, day after day, on account of a poor hand car, runs into money very fast. The foreman should give his hand car very close attention. He should inspect it every morning before going to work and see that all bolts are



Rail Rests to be made of second hand trestle stringers.

securely fastened and that all bearings are clean and well oiled.

Motor cars have been in use on some entire divisions in the past year or so and with good results and saving some money. We recommend this feature of the car question be given consideration.

Track tools of all kinds should never be used for any other purpose than that for which they are made. Track shovels should never be permitted to be used in holding up the ends of ties while tamping, in pulling ties out of track or putting in new ones; nor should they be used for spacing ties in the track. Claw bars should not be forced under the head of a spike by hammering the heel with a spike maul; sufficient wood from around the head of the spike should be cut with an adz or sharp pick to permit the claw bar to grasp the spike head. Nor should they be used between the tie and rail to lift the rail. This treatment is liable to break the claw, especially in cold weather.

Lanterns should always be kept in first-class condition, ready for an emergnecy call, except that they should not be left standing or hanging up in the tool house with the cup filled with oil, as this will spill the oil and rot the wick.

When through with the day's work all tools should be conveyed to the tool house and locked up for the night. Track gages and track levels should be tested frequently to ascertain if they are true and correct.

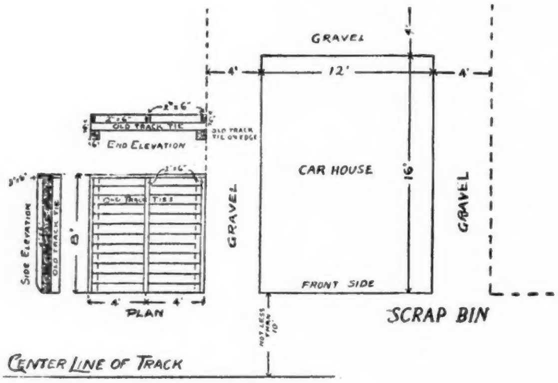
Scrap.

All scrap should be picked up daily and placed with the other scrap, where it can be secured by the scrap crew when required. We would recommend that the scrap be picked up once a month. The scrap bin for small scrap should be provided at each section tool house, with two compartments, each 4 ft. x 4 ft.; one compartment for small track scrap and the other for car scrap. We would recommend as a design for a scrap bin the accompanying sketch. All scrap should be picked up daily and placed in it at the close of the day's work. Whenever any old worn-out wooden cattle guards or other worn-out equipment of this kind is burned as rubbish, all the bolts, nuts, washers or other metal should be picked out and conveyed to the scrap bin. When old tie piles are burned, the ashes should be raked over and the old spike stubs, which in many cases are quite plentiful,

should be picked up by the track men and saved as scrap. Its value will more than pay for gathering it up and it will educate the men on the matter of economy. Whenever any usable parts of cars or locomotives are picked up, such as draw bars, car doors, brake-shoes or any other usuable material, they should be at once sent to the shops, where they can again be put to some use.

In conclusion, we wish to say that the results obtained in the care of track material and tools depend, in a larger measure than in any other part of their work, upon the interest taken in the matter by the foreman and his men, and we believe the surest way to bring about the results desired is to create a sense of the value of property among the men by continually impressing upon them the fact that all tools and material should be cared for just as conscientiously as if they were their own personal property. This impression will go fully as far as the most careful instructions.

Committee, A. E. Hansen (Chairman), C. & N. W., Green Bay, Wis.; J. W. McManama, B. & M., Waltham, Mass.; James Sweeney, C. & E. I., Danville, Ill.; M. Lumn, Wabash, Montpelier, O.; C. Mushcott, Pere Marquette, Muskegon, Mich., and C. H. Cornell, C. & N. W., Antigo, Wis.



One member said that ties should be peeled before piled. C. E. Jones, of the Chicago, Burlington & Quincy replied that no up-to-date road would purchase unpeeled ties, but Charles H. Cornell, Chicago & Northwestern said that was just what his road was doing. Such ties were received from the woods freshly cut and were peeled by the railway company after being purchased and before piling. A. M. Clough, of the New York Central objected to the practice of piling ties along the right of way. He thought the proper place to pile ties to be in the material yards, from which they should not be hauled for distribution until the section men were about ready to put them into the track. At that time they should be thrown off the cars, all along, promiscuously, about where they were needed, so that there would be no necessity for piling. J. M. Meade, Santa Fe, advised against the plan of piling creosoted ties close together, owing to the danger of fire. He had seen many creosoted ties burned up by being so piled. An inquiry was made as to the durability of creosoted ties, and Mr. Clough said that 18 years ago he had laid for experimental purposes a piece of track 20 rails in length. In this track he had laid cedar ties with and without tie plates, and, among others, twelve cresospted yellow pine ties. Ten of these creosoted ties are now in sound condition. President Sweeney told of the experience of the Chicago & Eastern Illinois with black oak, jack oak and ties of other inferior timbers treated with zinc chloride, beginning in 1898. With the exception of those laid during one year when the treatment was poor, all the treated ties are still in the track and in good condition. Ties of these different kinds of oak are laid without tie plates. Mr. Meade said that the method of treating ties with creosote (rueping process) which is practiced by his road, the Santa Fe is costing 20 cents each. Comparing the plain zinc chloride treatment (burnettizing) with that of zinc chloride with glue and tannin added (wellhouse process), he was much in favor of the use of the glue and tannin. Inferior pine ties treated with this method had lasted an average of more than 12 years in the Santa Fe tracks, whereas those treated by the plain zinc chloride process had lasted only four years. He found that the plain zinc chloride treatment corroded the spikes more severely than when the glue and tannin were added. G. M Greene, C. R. I. & P. said that his road had been using hemlock ties treated with zinc chloride, since 1897, and most of these ties were still in good condition. Red oak ties treated by the same process and laid during the years 1904 and 1905 were not so durable, as a large percentage of these had already been removed from the tracks by reason of decay.

Supplying Switch Ties.

The discussion next turned upon the question of supplying switch ties. Mr. Clough was not in favor of sending out switch ties until they were ordered, and he was not in favor of ordering them until they were needed for renewals. Speaking of the renewal of switch ties, he had found that in general work it was more economical to renew them "out of face" than to renew only part of the ties at a time. In his practice he renews them both ways, but where all of the ties are well along toward decay he renews the whole set at one time. In fewer cases, where some of the ties are found to be pretty sound, they are allowed to remain and only part of the set is removed.

Switch Targets.

Extracts from Committee Report.

The chairman suggested this subject of the executive committee with the hope that a decision would be reached, recommending the standard now in use on the Union Pacific and other western roads, of doing away with the sight of the target when the switch was set for the main-line movement, and to show a red target when set for the side-track only. Personally, I endorse and approve of the Union Pacific standard. Below are copies of the opinions of the different members of the committee.

J. G Hutchison, C., R. I. & P.—The switch target should consist of a single plate which should be large so that engineers will make no mistake when approaching it. I believe that something similar to this is the coming switch target.

I never could fully understand, since I started on track work in 1876, why the railroad companies were so extravagant in using so many targets on their switch stands when one should suffice, the same as on an order board. There is no use for more than one target on a switch stand, and that should be painted, or enameled, red and securely fastened to the staff in a manner to indicate only when the switch is set for the siding or turnout. There is no more reason for having more than one target on a switch stand than there would be for having white and green bags along track to show that it is safe.

We should have green and red lights on switches to locate them at night, but the stands as well as the turnouts can be seen in the day time. A switch stand with more than one target may be ornamental, but not useful, and it runs the cost of maintenance up into thousands of dollars to a large railroad company without reaping any benefit.

There would be far fewer accidents at switches and less ground for excuse on the part of engineers in case of running into an open switch to say that he could not tell whether the switch was right or wrong on account of the targets being faded and dim. With only one target and that enameled red an engineer approaching switch and finding the target full face red he knows positively that the

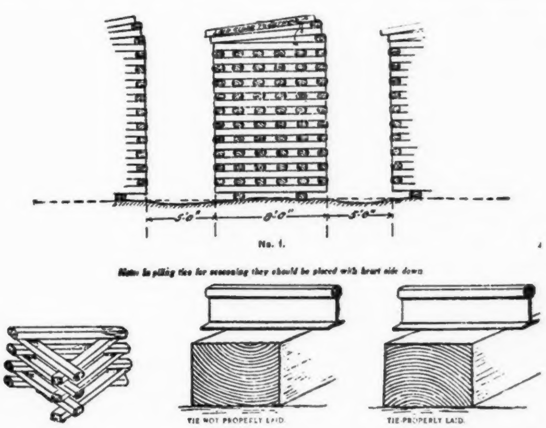
switch is set for the turnout. All targets of the signal style, as I have advocated, should be securely riveted to the staff, so that there can be no chance of its being shaken off by the movement of trains or high winds.

Where two switch stands are close together one of them should have a higher staff than the other so that one target and light will show plainly above the other. Where switches are located on curves or in sags a high ladder target staff should be used.

I notice that the Union Pacific has adopted the single switch target over its entire system, and in making inquiries among their roadmasters they claim that the single target has been very successful. This reduces the first cost of their switches and the maintenance of same.

Where possible all switch targets should show on the right-hand, or engineer's side of the track approaching the turnout.

W. H. Putcamp, Union Pacific.—It is a practice on all of the Harriman lines to use only the red target and I am very much in favor of only one target at a switch. I, myself, would suggest that a target on main line be at least 14 inches in diameter and painted red, and so adjusted on the switch stand that when switch is thrown for the passing track or leading from the main line, the target will show red. I would not advise having a white target or any colored target on the same stand. I cannot see the necessity of the extra target for the reason that when the track is clear and the switch is in proper condition, it is not necessary to have any target. When the switch is thrown out of position for main line we should have a red target, and I not think we



can make this any too prominent for safety. I would prefer a round target, possibly as large as 18 ins. in diameter on main line and 12 ins. in diameter on side tracks or in yards.

As for switch lamps the Union Pacific is using red and green lights on facing-point switches on double track and on all main-line switches on single track. We do not use any lamps on trailing point switches. This practice seems to be very satisfactory, and I think it would make a good standard for adoption by other roads.

H. Hermans, Chicago & Northwestern.—No target should be shown for the main line position of the switch. For side tracks a large red disc should be used, so that it can be plainly seen at a good long distance.

F. D. Harrigan.—The market is flooded with switches recommended for main line work that should have a place only in turnouts from side tracks. The majority of them are of a pattern equipped with one circular target and another of a shape varying with the make of the stand, one colored red and the other white and each set at right angles to the other. From the center of these targets to the top of the head blocks I find the distance in the majority of cases is about 5½ ft. Experience has proven a stand of this pattern to be insufficient protection for a high-speed train movement, because of the difficulty experienced by enginemen in establishing at a distance, with any degree of certainty, the position of the switch points as indicated by the target. Especial reference is had here to daylight running.

After considerable experiment and thought on the subject, I have arrived at the conclusion that a target of the semaphore type with dimensions and location as follows, will overcome the aforesaid difficulties wholly or in such large measure as to warrant its adoption: The blade should be 3 ft. in length, at least 7 ins. in width, and colored red, with a vertical white stripe 6 ins. in width across it, 8½ ins. from the outer end. This target, to insure best results, should be placed at least 12 ft. above the head block, in a horizontal position, at right angles to the track, it should denote a switch set for the turnout. In a position about 80 deg. downward from the horizontal it should indicate a switch clear for the main line.

I have had experience with targets of both patterns described herein and have ridden on the headend approaching switches equipped with targets of both patterns, and know for a certainty that the target last specified is visible from the engine cab when it is actually impossible to even see the stand equipped with the first mentioned circular target. Under favorable weather conditions it is possible for an engine crew to see this semaphore target at a sufficient distance to bring a high-speed train to a stop before reaching the switch.

An additional advantage of this semaphore target over the first mentioned pattern is its boldness when set in a position indicating an open switch. It is a fact that a circular target becomes a monotony to an engineman's vision.

A. M. Clough, N. Y. C. & H. R.—Let me say, however, that I do not approve of a single target for main line movement, inasmuch as it is dark one-half of the year. If, as I assume, not one member of our committee would think of dispensing with the all-right signal at night (our all-right clear signal is green) there should be an all-right indication in daytime also. If not, why not?

I have read in one of the technical journals of an attempt on a European road to have a light or indication of any kind only when stop or caution was intended; an absolute clear track to be entirely dark at night or without signals in daytime. It is not a bad idea, and is certainly less confusing than the hundreds of blades, targets and lights that the poor engineer has to pick his way through on our lines. Yet while we continue to have night indications on switches of whatever color for clear track we should have the same indication by target of prescribed dimensions in daytime.

Our main tracks are signaled throughout by automatic block signals and, happily for the roadmaster, the switch stands and targets are very little in use; but on side lines we use for main track targets a round disc, and for the side-track indication a semi-square.

It was shown further that the single target, or one which displays the edge for clear track and the blade broadside for the open switch, is now standard on a good many of the important roads, including the Chicago & North-Western, the Union Pacific the Great Northern the Michigan Central and some other roads. A. E. Hansen said that the single target has been standard with the Chicago & North-Western for a good many years. Formerly this target was made to show flatwise for safety and edgewise for open switch, but this practice has been reversed, so that the target now shows edgewise when the switch is closed and the main track is clear. James Burke, of the Erie, discussed this matter at some length. He favored the single target, showing a large red banner for the open switch and edgewise for clear track. His road, however, is using the double target, or

one that shows with the switch in either position. On double-track lines his road has no lights at all for trailing switches at night, and in most cases no target for day-time indication. For facing switches distant signals are used. Several of the members told of high targets, 14 ft. to 18 ft. from the ground, and some are using semaphores on the switch stands for high-speed tracks. After a pretty full discussion the question was put to a vote, and the convention stood 25 to 24 in favor of the single target for switch stands, for all roads.

The report of the committee on cattle guards was brief, and was essentially as follows:

Cattle Guards.

The old-style pit guard, which was in use for a number of years, served its purpose, and without a question was the most effective of any guard yet constructed, but for several reasons it was considered dangerous, as cattle, once getting into the pit and not being able to get out, have caused derailments. Then again, various railroad accidents were caused by the stringers and the pit guard catching fire, in some way, and burning out. These and others are the reasons why the railroad companies some twenty years ago were looking around for a surface guard.

Slat guards made of wood are used on several roads to some extent. They, however, are not reliable as a guard to keep stock off the right of way. They are made up in sections of equal size, 32 inches wide by 8 ft. long, requiring six pieces for a complete guard at each highway crossing for single track. Metal guards of various kinds have been tried, and most of them have shortcomings, being either torn out or damaged by loose, dragging brake beams, and for that reason they are not perfect.

The Sheffield cattle guard is used extensively on several of the largest railroads in the country, and without a question it is a good guard. First, as to its simplicity, there are only four sheets in a set of this kind of guard. Two of them go between the rails, and one on each side, for standard-gage tracks. The sheets are 26 inches wide and 8 or 9 ft. long, as may be preferred. The cost of placing these guards in position is nominal. All the labor required is to lay the sheets in proper position and drive three spikes in the end of each of the sheets. The removal of the guards when necessary to surface the track is easily done by pulling the spikes and lifting the guards out.

The National guard was about the first one of the surface type to be put on the market. Other guards were also manufactured, but of very light metal—so light that there was no life to the guard, and the steel surface cattle guard was tabooed on that account. Refrigerator cars pass over most of the railroads today, and the drippings from them will, in some cases, deteriorate or rust out a guard very rapidly.

The Perfect steel surface cattle guard is highly recommended by many roads, and in our opinion is the most effective surface guard on the market today. In the Perfect guard the punishment and the pit features, the semi-pit and like ideas are eliminated. The guard is applied to existing ties, it being necessary simply to give bearing for the side plates at the ends. There are no sharp points, no holes, no slats on which animals are expected to step to make the thing work. The idea has been to eliminate all things calculated to maim or disable the animals or to present danger to life and limb of man. Animals at the initial step slide the toe first into the slot at the base, when it is impossble to proceed further. At the same time, the leg is free to be withdrawn without the slightest injury to the hoof. Repeated efforts only discourage; and the animal quietly desists from any further attempts to cross this guard.

J. A. Kerwin, Missouri Pacific spoke of a long experience with the Sheffield guard, particularly while he was with the Missouri, Kansas & Texas in Indian Territory, now Oklahoma. He knew of nothing on legs that was harder to frighten than Texas long-horned steers, and he had seen this species of animal go against the Sheffield guard. On the first one or two experiences they would go over it, but, like a man with a nail in his shoe, soon got tired of the punishment and became more respectful of the guard. J. D. Brunk, K. C. M. & O. is trying cattle guards that throw a gate across the track as soon as the animal steps on the device As soon as the foot is removed it goes back to place, clear of the track. Most of the speakers expressed a distrust of all kinds of surface guards for holding cattle that are in the habit of running at large.

Amendment to By-Laws.

The next matter brought up was a proposed amendment to the by-laws making a past president of the association eligible for re-election to that office after a period of one year out of the office. The amendment was put to vote and carried.

Election.

The election of officers resulted as follows:

President, Thomas Thompson, Atchison, Topeka & Santa Fe.

First Vice-President, L. C. Ryan, Chicago & Northwestern.

Second Vice-President, D. E. Lynch, Chicago, Burlington & Quincy.

Secretary and Treasurer, W. E. Emery, Peoria, & Pekin Union (re-elected).

Member of executive committee, Mr. M. Burke, Chicago, Milwaukee & St. Paul.

Messrs. C. E. Jones, C. H. Cornell and J. A. Kerwin were elected honorary members.

St. Louis was selected as the place for holding the convention next year, the second Tuesday in October unless changed by the executive committee after looking into the matter of making arrangements.

Thursday Meeting.

At the forenoon session on Thursday the convention was visited by F. O. Melcher, second vice-president of the Chicago, Rock Island & Pacific and by J. B. Berry, chief engineer of the same road. Mr. Melcher compared his own experience at railroading in the East with that in the West. He had worked in the maintenance of way department and had found that it served him in good stead as a managing railway official. Among other things he had observed that in the East heavy track and plenty of ballast had preceded heavy power, whereas in the West the improved track and ballast had frequently followed the heavy power. Mr. Berry said, for one thing, that he was quite in the habit of consulting roadmasters and section foremen about various matters of track work and other engineering, and that he never did so without learning something.

The morning session was given over to the supply men for 5-minute talks about their appliances. A goodly number responded, some telling about the good points of their wares, while others turned the opportunity to account by way of entertainment. Mr. Anderson, of the American Valve & Meter Co., recited an original poem, while Mr. William Goldie, Sr., representing Dilworth, Porter & Co., told a darky story. Mr. W. C. Kidd, of the Ramapo Iron Works, first drawing attention to the claim that his firm had no competitors, and promising that he could talk of a more agreeable subject than switchstands, proceeded with a humorous discourse, well maintaining his reputation as an entertainer.

Insulated Joints.

Mr. T. Thompson, chairman of the committee on insulated joints and rail fastenings, reported as follows, in part:

"I find that the insulated joint is the weakest joint in the track. Most of the track fastenings used either side of the insulated joints on the A. T. & S. F. are Weber, continuous

and Wolhaupter joints, 24 inches long. Harvey grip ⅞-in. bolts being used and bolts staggered. In Weber joints, the bolts are not staggered.

"My experience has been that in insulated joints the rail will contract and expand due to not being properly anchored each side of the insulated joints, allowing the expansion to become wider than in any other joint. Consequently the receiving rail became battered and the joint, low and out of surface and line. As soon as the rail becomes worn after being in the track perhaps a year or longer, a great many rails in insulated joints flatten out at the joints and break at the first hole because of the blow on the receiving rail.

"As chairman of the committee, I would recommend that the insulated joint should be stronger than the other joints used each side, so as to prevent the expansion and contraction of rail in the joint. Too much opening of rails in insulated joints is bad and as a rule destroys the fiber sole plate, thereby cutting out the insulation. No more than one end post should at any time be used in insulated joints for protecting the circuit in the track. Where more than one end post is used, the expansion becomes too great and ruins the rail.

"I have seen a number of the different makes of insulated joints in use on different railroads. They are the Weber, Mock, Daves, Q. & C., Bonzano, Atlas, Abbott, ordinary plain angle bars and Continuous. I have paid particular attention to the service of the Mock and Continuous, the Mock having what is called an "easer" rail about two feet long attached to the joint sitting firm against the running rail and fastened to the plate by rivets, forming the sole plate. Some of the Mock insulated joints that I have seen on the Western Indiana tracks at Clark and 16th streets, Chicago have been in continuous service for about three years to my knowledge. As far as I can learn they have given very good results. The merit of the Mock joint is that it overcomes the flattening of the receiving rail by means of an easer rail. The easer rail carries the load off this joint and to the receiving rail away from joint. This is a very good feature.

"It has been brought to my attention that there were some insulated Continuous joints put on high-speed track on 80 lb. rail in 1907, and 80 per cent of these are still in the track and in good condition. Personally I have had no experience with the Continuous insulated joints, but I understand that surface and line can be very easily maintained with them. I think that the difficulty with most of the insulated joints in use is that the rail is allowed to contract and expand on each side leaving too much opening and allowing the joints to become low, and in this manner the receiving rail begins to flatten and gets a blow from every wheel passing over the joint.

"Particular attention should be paid to the surface and line of insulated joints. They should not be allowed to become low, but should be tamped up as often as it may become necessary to maintain good service. The rail should also be properly anchored each side of them, to prevent rail creeping."

The general opinion seemed to be that the greatest difficulty with insulated joints was to keep the end of the receiving rail from battering. President Sweeney was of the opinion that a ½-inch expansion opening at the joint is too much, setting up too much of a battering action. He is using two $\frac{5}{16}$-in. end posts, which is quite common practice, the two pieces chafing together wearing slower than would a single piece for an end post. D. Foley, of the Michigan Central said that he has had better success using the Weber joint supported than suspended. Mr. Clough spoke of the improvement brought about when the Weber insulated joint came into use, compared with the service obtained from the old wooden blocks. The latest improvement in the Weber type was the No. 3 style, on 3-tie joints. The most efficient device he had used, however, was to discard the wood filler and shoe of this joint, laying it naked on the ties with the fiber against the steel, on both sides. Mr. Thompson's best satisfaction has been with the Weber insulated joints suspended, using only one end post, with the adjoining rails well anchored with anti creepers.

F. A. Poor, speaking from experience advised the use of more than one end post and against the practice of slot-spiking insulated joint bars—they should be spiked for alignment, but no attempt should be made to hold these joints against creeping, as such practice was sure to set up undesirable strains. Creeping should be taken care of by anchoring the adjoining rails. From the standpoint of the signal man the best insulated joint was the old wooden blocks, but it was the poorest joint for the trackmen. The metal and fiber insulated joint was the best from the trackman's standpoint, but the poorest for the signal men.

T. F. Donahoe, of the Baltimore & Ohio and others spoke of recently introducing the Keystone insulated joint.

Rail Fastenings.

The committee on rail fastenings, of which also T. Thompson was chairman, reported as follows:

"A rail joint fastening should consist of as few parts as possible, the fewer parts the better. It should support the base of the rail as well as the head and fit snugly, so that the rail cannot work up or down in the joint. It should have sufficient strength to make the joint at least as strong as any other portion of rail, and the length should not exceed 26 ins., with four bolt holes. The bearing should be on two ties with the joint between and the holes through the base of the joint should be spiked to the tie with not less than one or more than two spikes on each side in each tie. The holes in the fastenings should be punched, so that the spikes will not interfere with the nuts on the bolts.

"The holes in the joint should be made so that the bolts are alternate; that is, every second bolt with head in and the others with the heads out, to prevent all nuts from being broken off in case of derailments. This will save at least half the bolts in the joint and will always leave enough to keep the track safe until it can again be full bolted. The holes in fastenings should be made oblong on one side and round on the opposite side, so that the shoulder of the bolt will fill up the hole on the oblong side, and the end of bolt will fill up the hole on round side. The holes in the rails should be made large enough to allow the rail to expand or contract. Bolts for rails from 80 lbs. per yard and upward should not be less than 1 in. thick, with square nut and a shoulder next to the head large enough thoroughly to fill the oblong hole in the angle bar, so that the bolt cannot work when the nut is being tightened.

"Joints should be gone over several times after they are put on, especially on new rail, and driven up against the rail and the bolts thoroughly tightened until they fit tightly against the rail, as it is often more the fault of the man in charge that some devices fail than the fault of the device, because they are not properly adjusted and taken care of after being put on.

"There are a number of patented rail fastenings which are good. The following are some of them: The Continuous rail joint, the Weber, the Hopkins combined rail and chair joint, the Q & C., Bonzano and common heavy angle bars reinforced at the joint. The committee favors a suspended rail joint in all cases. The chairman of this committee has had experience with the Continuous, Wolhaupter and Weber joints from 1902 up to the present time, on 75-lb. and 85-lb. rail. For good results I prefer the 24-in. Weber joint. The Weber joint has proved very successful in the way of keeping surface and preserving the rail from excessive wear at the joints. It also saves bolts. We have had fewer loose bolts in Weber joints than in any of the others used. The

Harvey grip bolt is used extensively by our company with the joints above named."

Mr. Clough said that the New York Central uses nothing but the plain angle bar joint, 36 ins. long, with six Harvey grip bolts, on three ties. They have no trouble in keeping up the joints and consider this old device the best form of rail joint. He does not approve of the use of nut locks. Quite a long discussion on nut locks and lock nuts took place, the point of contention being whether the use of a locking device was any improvement over the practice of screwing the nut down upon the splice bar direct. Opinion was about evenly divided, those favoring the nut lock giving, as their principle consideration, the fact that the nut lock prevents the destruction of the thread of the bolt, just under the nut, so that, as the contact surfaces wear and the joint becomes loose, the bolts can be further tightened to take up the slack.

M. Lumm, Wabash started a discussion on the method of slotting joint bars for spiking. He was not in favor of punched holes through the bar ("closed slots"), as, after these were once spiked, it was impossible to tighten the joint further, the spikes holding the bars against the pull of the bolts. The old-style way of slotting the edge of the bar ("open slots") was preferable, as such permitted the bars to pull away from the spikes when the bolts were tightened. Mr. Sweeney said that, in any event, the slot spiking of the joints should not be done until after the bolts have been tightened.

The next thing on the program was a paper on "Some Benefits of Association," by W. M. Camp.

Tie Plates and Rail Anchors.

A committee on tie plates and rail anchors, of which L. C. Ryan was chairman, reported against the use of tie plates having ribs or claws on the bottom. J. A. Kerwin offered as a substitute the conclusions adopted by the association in 1906. After some discussion it was voted to receive the report merely as information, without acting on the conclusions. This disposition, of the report applied to both tie plates and rail anchors. The part of the report referring to rail anchors is as follows:

"Rail anchors are a most necessary track appliance, especially on lines with two or more tracks. We think that an anchor having keys or bolts is not worth considering, as such parts are sources of continual trouble and expense and even with the most careful supervision they become loose at times, hence losing their effectiveness. Our idea of a rail anchor is that it should be made of but one or two parts, one part if possible; should be easy to apply and should be so constructed that when once applied it will grip the rail and become tighter, according to pressure of tie against it. There should be enough material in the jaws of the clamp where it pinches on the flange of the rail to prevent it from spreading under heavy pressure, thereby allowing it to lose its grip."

The business of the convention not being completed in the usual three days, a session was held Friday morning. A paper on "Treated Timber," by J. L. Single, read by the secretary in the absence of Mr. Single, was discussed to some extent, and it was voted that creosoting be the method of treating track ties recommended by the association.

After an official visit by William Goldie, president of the newly formed Track Supply association, the newly elected officers were installed and the convention was adjourned.

The entertainments during the convention consisted of an automobile ride for the ladies, on Thursday afternoon, and another automobile trip for both ladies and gentlemen on Friday afternoon. These entertainments were provided by the courtesy of the Track Supply association.

The attendance of roadmasters and other members of the association was good, numbering about 100, all told, during the three days. There was the usual number of supply firm representatives in attendance.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.

The third annual convention of the Association of Railway Electrical Engineers was held September 27, at the La Salle hotel, Chicago, with a good attendance. The secretary's report showed a total membership of about 486 and satisfactory financial condition.

The president, E. M. Cutting, engineer train lighting, heating and ventilation, called the meeting to order, and delivered the annual address. He felicitated the association on its work during the year and the fine exhibit by manufacturers. He then referred to the proposal to affiliate the organization with the Master Car Builders' association, and gave it as his opinion that they could do better and more efficient work as organized.

The report of the committee on illumination, in the absence of the chairman, H. C. Meloy, electrical engineer, Lake Shore was read by J. R. Sloan, electrical engineer, Pennsylvania. In the discussion, Henry Schroeder, General Electric Co., presented some facts concerning the present status of drawn-wire tungsten filament lamps. The tungsten filament is formed from metallic tungsten powder mixed with a binder and forced under heavy pressure through a die. It is placed in an inert gas and subjected to heat by passing an electric current through it. The metallic particles are fused together, and the filament takes on the nature of a wire. It is, however, quite delicate, and it has been the theory that if it were possible to draw tungsten wire from the metal, as ordinary wire is drawn, a more substantial material might be obtained. Experimental lamps have been thus made and tested but the results as yet are not uniform. The experiments are being continued, and there are hopes of success, in which event a lamp at once more efficient and less easily broken than the present product would result.

The report of the committee on data and information, of which D. J. Cartwright, electrical engineer, Lehigh Valley, is chairman, was presented in the afternoon.

The committee on accounts and reports presented its report next morning. The object of this committee, of which F. R. Frost, electrical engineer, Santa Fe, is chairman, was to suggest a standard method for calculating and reporting the cost of car lighting. The following is an extract from the report:

"The need of a standard method for calculating and reporting the cost of car lighting has long been felt as the methods used at present vary so much as to prevent an intelligent comparison of figures submitted by various railroads. Many reports submitted without explanation are incomplete. The committee has endeavored to devise a standard, but is unable to supply the details which must depend upon the organization of the railway. The method of calculation will vary with the purpose. For comparison only, the items common to two systems or classes or cars compared may be omitted. When considering dissimilar methods of lighting, all items of expense should be included. To make such comparison complete, the figures should be reduced to a standard, based on total effective illumination and hours of lighting. This would require more time and testing than ordinary conditions permit. Recommendations follow:

"The standard units of cost shall be the car month and the 1,000 car miles, both being shown. The car month shall be one car equipped for service for one calendar month, no deduction being made for service conditions or shopping periods. The car mileage shall include all mileage made by a car regardless of service conditions. A complete report on the cost of car lighting should include supervision, all labor, material and charging current, interest and depreciation on the entire investment, cost of power for operating head-end equipments and axle dynamos, cost of hauling apparatus, insurance and taxes. The labor and

material shall include all expense incident to operation, maintenance and repairs of all apparatus, wiring, conduit, switchboards, fixtures, sockets, shades and lamps. For Pullman cars the maintenance and repairs on battery boxes, conduit, wiring, switchboards, fixtures and shades should not be included. Recommended that comparative reports of cost of maintenance and operation for similar systems include no allowance for interest and depreciation, for power for operating head-end systems or axle dynamos, for haulage or electrical apparatus for insurance and taxes, as it is difficult to settle upon a satisfactory basis for calculating these items. In each report attention should be called to these omissions. Considerable valuable data can be deduced from reports if the average age and average cost of equipments be shown. The material should be separated into several items. With this information the engineer can add interest and depreciation to suit his own standard."

The committee suggested an interest rate of 5½ per cent, and depreciation due to obsolescence to 10 per cent.

D. J. Cartwright submitted figures for maintenance of Lehigh Valley equipment. He gave the total maintenance and operating costs of axle light equipments on 21 cars for a period of 21 months as follows, being the average per car per month in each case: lamps, $3.22; fuses, $0.13; belts, $1.63; generator parts, $3.53; regulator parts, including resistances, $.43; storage batteries on 22 cars, 38 sets of 16 cells each, $1.72; miscellaneous fittings, $0.30; total, $10.96 per car per month, including all materials used in making repairs and improvements, all damages due to wrecks, all labor costs, and the complete installation of one new equipment. He said that his storage batteries were of the old Gould, Consolidated and United States types and ranged in age from two to four years.

There was a demonstration and explanation of the Sharp-Miller illuminometer in railway practice by J. O. Heninger. This instrument affords a means of measuring the illumination upon a surface of any given point or position. It differs from the photometer, which measures the light emanating from any given source. The illuminometer affords a means of ascertaining the exact distribution of illumination and of comparing its intensity with the desired standard. Its peculiar application to railway service is in measuring the illumination at various points in the interior of shops or stations, or of cars, or of determining the intensity and distribution of the light from headlights.

The subjects for consideration in the afternoon included the report of the committee on standards, C. R. Gilman, electrical engineer, Chicago, Milwaukee & St. Paul, chairman, and a paper on the Ventilation of Railway Cars, by Bernard A. Stowe. Mr. Stowe's paper emphasized the unsatisfactory conditions now prevalent in car ventilation and urged earnest effort to solve the problems. Extracts from the report on the former subject follow:

"The train line connector Type G3 has been generally adopted by all the head-end lighted roads, and it should be but a short time until other types which do not connect with the G3 have disappeared. I believe we can say at this time that the connector question is settled. Polarity of train wires, positive to the right looking into the car, is also a settled standard. That all electrical connections on switchboards, terminal boards and batteries be made up with the positive on the right hand is settled practice. The two-compartment storage battery tank, lead lined or containing rubber jars, is generally adopted. A battery box of size to contain eight of these tanks, holding 17 plate cells in rubber jars, is adopted and is being placed on all new electric lighted cars. The standard train lighting lamps suggested by your former committee and the lamp committee of the N. E. L. A. last year are being used, and that there is a good general knowledge of the lamps on the part of purchasing agents and others handling them brought about directly by this association. Sixty volts for head-end lighted trains, and either 60 volts or 30 volts for straight storage and axle dynamo systems, was recommended by the Master Car Builders' committee at their June convention. We believe that those two voltages will be necessary for the present, or until such time as the development of electrical apparatus makes the lower voltage applicable to all systems. Sixty-four volts head-end system has gained some ground this year. One eastern road has adopted it as standard. One western road changed over two of its 110-volt trains and is getting ready to apply it to 18 new trains. The following recommendations made last year and not yet adopted are again recommended by your committee: 1.—All cars assigned or interchanged with head-end lighted roads be provided with 3 line train main wires and G3 connectors. 2.—Storage battery boxes to be placed in the center of the car, be made of iron, bottom lined with wood and inside to be protected with a heavy coating of acid-resisting paint. 3.—All cars carrying storage batteries to be provided with two charging receptacles, of a carrying capacity of 65 amperes, similar to the one shown in sketches accompanying report. 4.—All wiring under car to be in iron conduit. 5.—A fuse block enclosed in an iron moisture-proof box to be placed just outside of the battery box, to contain two 150 ampere knife fuses of code type. 6.—The rules of the fire underwriters to govern all car wiring. 7.—Knife blade national code type be used for all fuses of 31 amperes or over; ferrule type for 11 amperes to 31 amperes, and screw type for 10 amperes and less. 8.—All parts of suspension gear of axle equipment to clear any part of the car body 3½ inches and that same gear clear the track 6 inches when car stands level. 9.—Suspension gear to be so designed that the armature can be easily removed. 10.—When facing the end of the track on which the generator is mounted, the pulley to be on the right. 11.—A straight pulley seat to be provided on the axle. It is recommended that a bushing or sleeve that can be secured on be used. Dimensions for bushing 7½ inches external diameter, 8½ inches long, turned straight. That the pulley hub have an internal diameter of 7½ inches bored straight, the length of the hub be 6½ inches and the face be straight, 9 inches or wider if flangeless, 8 inches wide if flanged. 12.—The dynamo pulley to be 8 inches face, flanged, the face crowned and perforated, the flanged pulley with a perforated crowned face 8 inches wide be used on the dynamo. 13.—Each electric lighted car to be provided with a framed diagram of the wiring, placed in a conspicuous position. The following standards were suggested by the Master Car Builders' committee: 'Section 10. That where axle dynamos are used negative, positive and dynamo field leads shall be fused as close as possible to the dynamo, either at the joint at which these leads enter the conduit or are secured to the bottom of the car. The above fuses to be for emergency service only and to be at least 100 per cent above the capacity of the fuses on the switchboard protecting the same leads.' Your committee differs in opinion regarding this matter and hopes it will be fully discussed."

The report of the committee on specifications, A. J. Farrelly, chairman, electrical engineer, Chicago & Northwestern, which was on the program for Thursday forenoon, confined itself for this year to specifications for lamps, electrolyte, and the installation of car wiring. The discussion of Mr. Stowe's paper, on ventilation, read the previous day, was continued. An extended discussion was offered by William H. Lynch, an inventor, who conducted experiments upon the Grand Trunk some years ago, and more recently upon other roads. Mr. Lynch contended that the present widely accepted requirement of a certain number of cubic feet of fresh air per hour per person is a mistake. His argument was that the admission of fresh air only accomplished a dilution of the bad air, unless adequate means be provided for the removal of the ventilated air as fast as formed. He claimed that the factors of quality and distribution of the incoming air were equal or superior in importance to the factor of quantity. Closing the forenoon session, S. F. Nichols read a paper on the Electrical Operation of Drawbridges.

In opening Thursday afternoon's session, J. R. Cravath delivered an informal talk on the general principles of illumination

as affecting the car lighting engineer. Following this the report of the committee on train lighting practice, H. G. Myers, chief electrician, Santa Fe, chairman, was read by F. R. Frost.

The Railway Electric Supply Manufacturers' Association held its business meeting on Thursday afternoon. The exhibitors numbered about 25. The displays attracted much attention and favorable comment from the engineers present. One feature which was of especial interest by reason of its novelty was an installation of the "automatic enunciator" or loud-speaking telephone.

The convention was brought to a close Friday morning with the election of officers for the ensuing year. J. R. Sloan, of the Pennsylvania, was elected president; F. R. Frost, of the Santa Fe, first vice-president; D. J. Cartwright, of the Lehigh Valley, second vice-president, and Joseph A. Andreucetti, of the Chicago & Northwestern, secretary and treasurer. The executive committee will be F. E. Hutchison, of the Rock Island; C. J. Causland, of the Pennsylvania, and Alexander McGarry, of the New York Central lines.

The meeting in November, 1911, will be held at Chicago; the semi-annual meeting in June, 1911, at Washington, D. C.

The officers elected for the supply association were: President, A. C. Moore, Chicago; vice-president for the east, H. G. Thompson, New Jersey; vice-president for the west, George H. Porter, Chicago; secretary John Scribner, Chicago; treasurer, Edward Wray, Chicago; executive committee, G. H. Atkin, Roger M. Newbold and Otis B. Duncan all of Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATON.

The twentieth annual convention of the American Railway Bridge and Building Association will be held at the Albany hotel, Denver, Colo., October 18-19-20, 1910.

A general invitation has been extended to all railway officials, and others interested, to attend any or all of the sessions.

The committee on arrangements assure sufficient side trips to make this one of the most attractive outings in connection with the business sessions that has ever been had.

Officers.

President, J. S. Lemond, Southern Ry., Charlotte, N. C.

First Vice-President, H. Rettinghouse, C. & N. W. Ry., Boone, Iowa.

Second Vice-President, F. E. Schall, L. V. R. R., South Bethlehem, Pa.

Third Vice-President, A. E. Killam, I. C. R., Moncton, N. B.

Fourth Vice-President, J. N. Penwell, L. E. & W. Ry., Tipton, Ind.

Program.

TUESDAY, OCTOBER 18.

Morning Session.

Call to order by the president at 10:00 a. m.
Prayer.
Address of welcome by Robt. W. Speer, mayor of Denver.
Address by A. D. Parker, vice-pres. Colorado & Southern.
Roll-call.
Reading of the minutes of last meeting.
Report of committee on membership.
Admission of new members.
Recess for payment of dues and reception of new members.
President's address.
Appointment of committees.
Annual reports of the executive committee, secretary, treasurer, committee on memoirs and relief committee.

Afternoon Session.

Call to order at 2:00 p. m.
Committee reports.
Reading reports of committees on investigation.
Unfinished business.
New business.
Discussion of last year's reports.

Evening.

Call to order, 7:45 p. m.
Paper entitled, "Regularity and Safety," by H. Rettinghouse.
Discussion of reports.
Adjourn, 9:30.

WEDNESDAY, OCTOBER 19.

Call to order, 9:00 a. m.
Discussion of reports.
Unfinished business.
New business.
Adjourn, 12:30.

It is possible that a side trip will be arranged for the afternoon, and some form of entertainment for the evening.

THURSDAY, OCTOBER 20.

Call to order, 9:00 a. m.
Unfinished business.
Reports of committees.
Election of officers.
Selection of location for 1911 convention.
Adjourn, 12:30.

The afternoon will be occupied by a side trip on one of the railroads and the evening by a banquet. The committee on arrangements is preparing for a trolley ride for the entire party, an auto ride for the ladies, a theater party and perhaps a visit to one of the beet sugar plants in the vicinity of Denver. It is quite likely that an all-day trip on one of the railroads will be planned for Friday.

Committees on Subjects for Report and Discussion.

I. Method of Protection to Embankments against currents and of restoring same when washed out.
E. L. Loftin, Q. & C. Ry., Vicksburg, Miss.
O. T. Nelson, J. M. Bibb, P. W. Cahill, C. A. Thanheiser, E. K. Barrett.

II. How to prevent Iron Pipe Culverts from pulling apart in soft ground, and how best to repair them when pulled apart.
A. A. Page, B. & M. R. R., Wilmington, Mass.
W. H. Moore, R. O. Elliott, H. C. Thompson, F. C. Rand, J. S. Browne.

III. Concrete in Railroad Construction; kind of reinforcement and waterproofing when necessary.
C. W. Richey, P. R. R., Pittsburg, Pa.
W. M. Clark, G. H. Soles, Stanton Bowers, W. H. Finley, T. L. D. Hadwen, W. A. Rogers.

IV. Arrangement of Buildings and Platforms, for small towns, as to convenience and appearance.
C. H. Fake, M. R. & B. T. R. R., Bonne Terre, Mo.
N. H. Lafountain, A. W. Merrick, J. S. Berry, R. C. Young, F. D. Beal.

V. Best method of Determining Proper Dimensions of Openings for Waterways.
W. T. Main, C. & N. W. Ry., Chicago.
Hans Bentele, Onward Bates, J. S. Robinson.

VI. Best method of obtaining Elevation on Curves on Bridges and Trestles.
J. P. Snow, B. & M. R. R., Boston.
W. F. Steffens, A. Finley, D. G. Musser, M. Burpee, F. L. Burrell.

VII. Best method of Numbering Bridges.
I. F. Stern, C. & N. W. Ry., Chicago.
E. B. Ashby, Wm. Graham, W. H. Wilkinson, C. N. Monsarrat, R. H. Reid.

VIII. The Economy and Practicability of Wire Glass in Roundhouses, Shops and Station Buildings.
E. E. Wilson, N. Y. C. & H. R. R., New York City.
C. F. Spencer, W. F. Strouse, G. W. Andrews, W. E. Alexander, A. Anderson.

IX. The Best Style and Dimensions of Hoops for Water Tanks of 50,000 to 100,000 Gallons Capacity.
F. E. Weise, C. M. & St. P. Ry., Chicago.
C. E. Thomas, J. B. White, John Ewart, Jas. Dupree.

X. *Plans of Fireproof Oil Houses for storing large quantities of oil at principal terminal stations.*
G. W. Rear, Sou. Pac. Co., San Francisco.
F. Ingalls, E. R. Floren.

ED. M. GILCHRIST.

Ed. M. Gilchrist, civil engineer for the Centerville division of the C., B. & Q., while traveling over his route on his railroad motor cycle, was struck by an extra Saturday morning, July 16, near Milan, Mo., and injured so that he died that night at 10:50. He was born in Westminster, Vt., on January 18, 1846. At the age of 16 he enlisted in the 71st Ill. Vol. Infantry, on July 16, 1862. In March, 1864, he was appointed 2nd lieutenant in the 12th La. Vol. Inf., afterwards U. S. Col. Inf., Co. H. In February, 1865, he was promoted to a 1st lieutenantcy and in November, 1865, to a captaincy When the Carthage and Quincy was built Mr. Gilchrist was one of the surveying party that located the line during the winter of 1870-71. He retired to a farm near Adrian, Ill., for a number of years, and then returned to engineering work. For 31 years he was with the C., B. & Q. in various capacities in the engineering department.

Construction.

Board of Public Works, Chicago, Burlington & Quincy, Chicago, Rock Island & Pacific, Minneapolis & St. Louis and Des Moines Union Pacific, Des Moines, will build a viaduct at Seventh street, to cost $225,000. Will have concrete piers and reconcrete slabs with steel girders 2,700 ft. long over all incoming approaches. Contract for sub-structure awarded to Thomas Phee Construction Company, Western Union Telegraph building, Chicago. J. W. Budd, city engineer, City Hall, Des Moines. C. H. Carthlidge, bridge engineer, care of Chicago, Burlington & Quincy Railroad, 209 Adams street, Chicago. A. D. Page, consulting engineer, 338 Postal Telegraph building, 145 Van Buren street, Chicago. Work is in progress on substructure.

The Georgia Railway Company has awarded the contract to John W. Wright, Union Springs, Ala., for building a line from Andalusia, Ala., to Pensacola, Fla., a distance of about 85 miles.

The Pensacola, Mobile & New Orleans has awarded contracts for the construction of its road from Pensacola, Fla., northwest to Mobile, Ala., 60 miles, as follows: Henry McLaughline, Pensacola, Fla., has grading contract for work on section of 10 miles, and C. W. Merritt, Pensacola, Fla., has contract for grading from Loxley to Mobile Bay.

The Bowden Railroad Company, a branch of the Central of Georgia Railway, has awarded a contract to J. W. Wright, Jr., Union Springs, Ala., for building a railroad 12 miles long, from Mandelville to Bowden, Ga.

The Baltimore & Ohio has awarded the contract to the Eyre-Shoemaker Company, Philadelphia, Pa., for work on its 17-mile grade at Everett tunnel.

The Chicago & Northwestern has awarded the contract to Peppard & Co., Minneapolis, Minn., for the construction of an extension of its system at the western end of the Menominee iron range.

The Rockingham has awarded the contract to H. W. Allport Company for the construction of the line from Roberdell No. 1 (3 miles northeast) via Rockingham to Gibson, N. C., a distance of 24 miles.

The Ontario & Western Railroad Company has awarded the contract to the McDonald Construction Company for building 11 miles of double track on the Scranton division, between Pleasant Mount and Winwood.

The New York, New Haven & Hartford has awarded a contract to N. E. Construction Company, 274 Main street, Springfield, Mass., for double tracking, grading and masonry on its line from Warren, R. I., to Fall River, Mass. This will cost approximately $150,000.

The United States Reclamation Service has awarded the contract to George B. Brady, El Paso, Tex., to build a branch railroad from a point on the Santa Fe 5 miles south of Engle, Tex., to the Engle dam, 10 miles.

The Missouri, Kansas & Texas has let a contract to Patton-Gibson Company to build extensive yards west of Denison, the same contractor having been double tracking the road; and a contract to the Patton-Gibson Company for constructing extensive yards west of Denison, Tex., in connection with the Ray yards.

The Kettle Valley has awarded a contract to L. M. Rice & Co., of Vancouver and Seattle, Wash., to build an extension to its line from Rock Creek to Bull Creek on the fork of the Kettle River, a distance of 35 miles.

The Baltimore & Ohio has let a contract to Bennett & Talbott, Greensburg, Pa., for building an extension 7 or 8 miles long from Hardman switch, several miles east of Grafton, W. Va.

The Baltimore & Ohio has awarded a contract to the Roberts & Schaeffer Company, 84 Van Buren street, Chicago, Ill., for constructing a coal station at Sir Johns Run, W. Va.

The Gulf & Magnolia railroad, at present a short line, and originally planned to extend only from Magnolia to Hope, Ark., may eventually extend from Monroe, La., to some point in Kansas, where it would connect with the Union Pacific, according to S. Q. Sevier, of Camden, Ark., the president of the road.

Progress on the construction of the Western Maryland's new extension from Cumberland, Md., to Connellsville, Pa., has encouraged officials of the company to believe that by November 1, 1911, the new line will be completed, and turned over to the operating department. The Carter Construction Company, of Chicago, which has undertaken the work, has given assurances that the line can be completed within fifteen months. The construction company, under the contract, will receive a bonus of $3,000 per day for each day under the specified fifteen months in which it is bound to turn the completed line over to the railroad company. On August 15 the contractors had 2,700 men and 306 animals at work. There are now in service more than 30 steam shovels, each with a capacity of 2,000 cu. yds. per day. Forty-one narrow gauge locomotives are also in service. All of the equipment is new.

The Big Four railroad company has begun a very important improvement in the bridge over the Kickapoo creek, just west of Downs, Ill. The trestle work bridge at that place, which is 400 ft. long, will be torn down entirely and almost three-fourths of that length filled in with solid earth. The bridge is to be replaced by four concrete arches, the three at the west side being of 20-ft. span, the west one to carry the usual water of the creek and the other two to take any possible flood that might occur. The fourth arch at the east side will be of 20-ft. span for a wagon roadway to pass beneath the tracks. This is a $30,000 contract, and all the work is to be completed about December 1. The contractor is A. J. Yauger, of Pekin. Much of the excavating for the concrete abutments has already been done and the temporary support for the track put in. These are for the most part mud sills, only a few piles having been driven.

J. H. Knowles, assistant engineer of the S. P., L. A. & S. L. at Salt Lake City, Utah, has been appointed a division engineer on the Western Pacific, with office at Elko, Nev.

Clarence W. Coleman, electrical engineer of the Hall Signal Company, New York, and for many years a member of the Railway Signal Association, died at his home in Westfield, N J., on Monday, October 3.

The Signal Department

Editor, Railway Engineering:

The signal standards running in your paper fill a long-felt want. Not only are they welcome as a stimulus to standardization on individual roads, but by showing what the other fellow is doing, serve the mutual interest of manufacturer and purchaser alike.

The road with which I am connected buys battery cells in large quantities. We have depended largely on the manufacturer to work out details. Your July issue shows the standard well of the Boston & Albany. Embodied in this are details for which we have wrestled with the manufacturer for months. The hood for trunking, cover, etc., were accepted on sight as a solution of our troubles.

This example is quoted merely as illustrating the usefulness of an interchange of ideas. You have furnished the medium—let the good work go on. Give us more, not only up to date, but up to the minute.

Chicago. Chief Draftsman.

Railway Signal Standards No. 10—The Southern Railway.

The Southern uses normal clear electric motor automatic block signals. At present both upper quadrant three-position and lower quadrant two-position signals are in use, but hereafter only upper quadrant will be installed. The standards of the Railway Signal Association will be used as fast as adopted. Night color indications are: white for clear, green for caution, red for stop. Mechanisms are at the base of the post. Two types of spectacles are used; one like that shown in Fig. 179 and the other in Fig. 239.

Signals are operated and line circuits controlled by potash battery housed in a case at the base of the signal. Track batteries are housed in cast iron chutes similar to that shown in Fig. 47, and consist of two or three cells of gravity. The average length of track circuits is 3,000 ft. Gravity battery details appear in Fig. 240.

Line wire is not strung on a separate pole line. Common return is broken every ten miles.

The blade and blade bolt appear in Fig. 241. Fig. 242 is a perspective view of the signal foundation shown in Fig. 243 with chute and ladder foundation. This also shows how wires are lead into the case.

Wire ducts consist of wooden trunking and capping; Fig. 244 runs above ground. Bootlegs are made as shown in Fig. 245.

Fig. 246 shows method of bonding a joint and dimensions of bond wires. Fig. 247 shows how track circuits are taken through switches and the method of bonding a frog. Switch indicators are not used at present.

Typical circuits for drop annunciator and power operated distance signal with indication lock are shown in Figs. 248 and 249, respectively.

Track relays are of the enclosed type, four ohms resistance. Ground connections are made to a 7-ft. iron rod driven into the ground.

The following sizes and types of wire are standard: For line No. 10 B. & S. gage hard drawn copper; for bootlegs and leads from track No. 9, B. & S. gage, rubber covered copper; for leads from line and battery, No. 14 B. & S. gage rubber covered copper in chutes, No. 14 B. & S. gage stranded rubber covered copper wire.

Specifications for foundation concrete is as follows:

"Cement 1 part, sand 2 parts, broken stone 4 parts; cement and sand to be well mixed dry, then spread over the stone, and all mixed with sufficient water to quake when tamped. Concrete to be turned before it is in place. Foun-

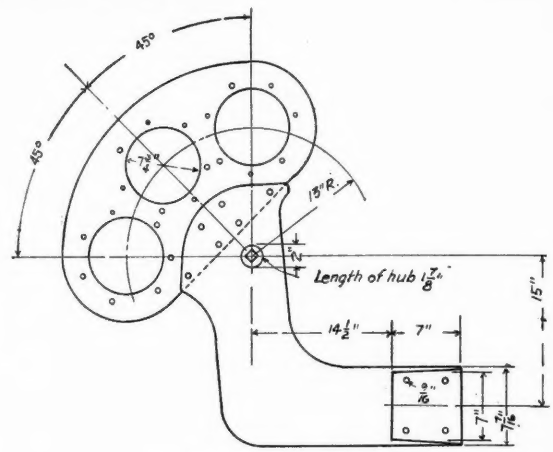


Fig. 239. Spectacle. Southern.

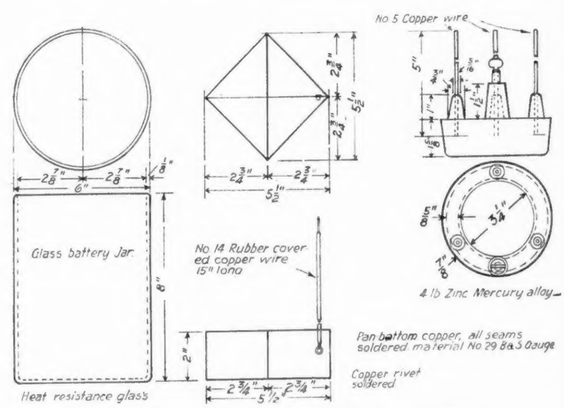


Fig. 240. Gravity Battery Details. Southern.

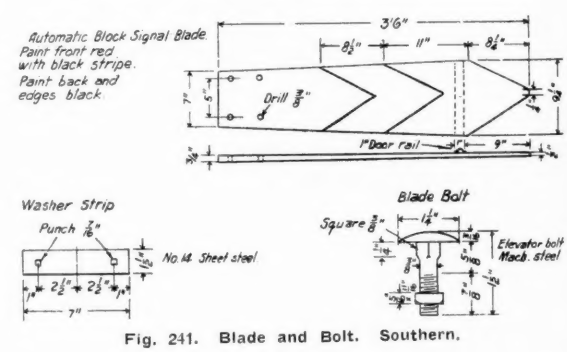


Fig. 241. Blade and Bolt. Southern.

dation to be faced above the ground with 1/6 bbl. Portland cement and 1/3 bbl. sand, well mixed. Concrete to be well tamped to place and to stand 24 hours before used."

Below are specifications for trunking:

"Trunking shall be of pine in lengths of 12 ft. or more and have mitered ends. It shall contain no knots over ½-in. in diameter, and they must be sound and hard. Joints will be supported on stakes with a piece of 1-in. board not less than 12 in. long directly beneath the joint and on top of the stake. Nails must be driven carefully so as not to strike the wires or enter groove. Nails must never be driven in the groove. Cross trunking must never be less than three-tie spaces from the rail joint. The bottom of line trunking shall

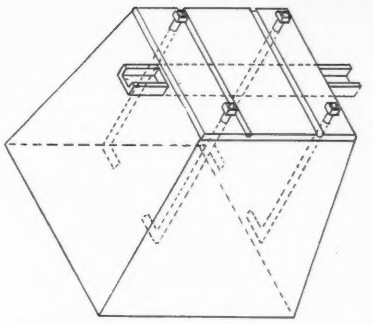


Fig. 242. Signal Foundation. Southern.

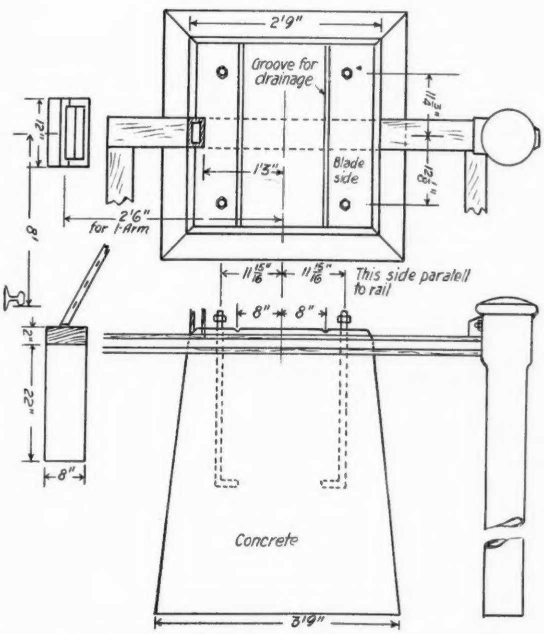


Fig. 243. Signal Foundation and Details. Southern.

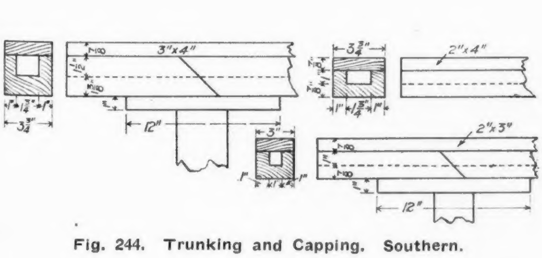


Fig. 244. Trunking and Capping. Southern.

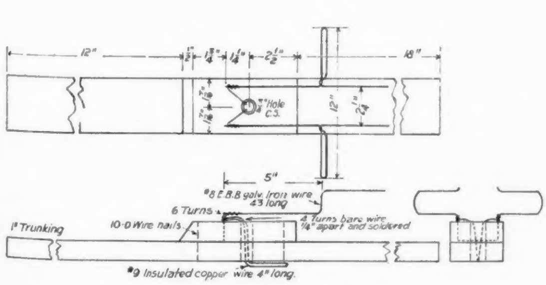


Fig. 245. Bootleg. Southern.

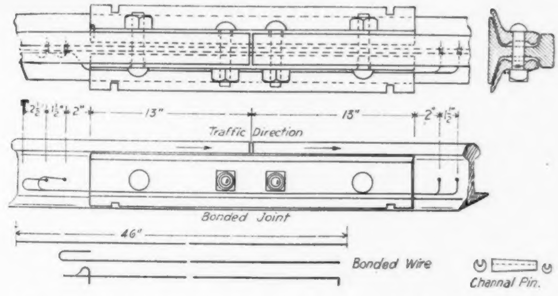


Fig. 246. Method of Bonding Joint and Bondwires.. Southern.

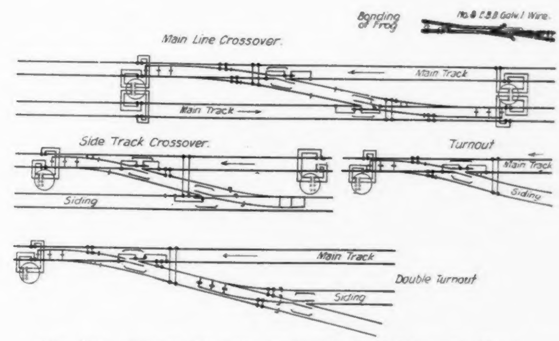


Fig. 247. Track Circuits Through Switches. Southern.

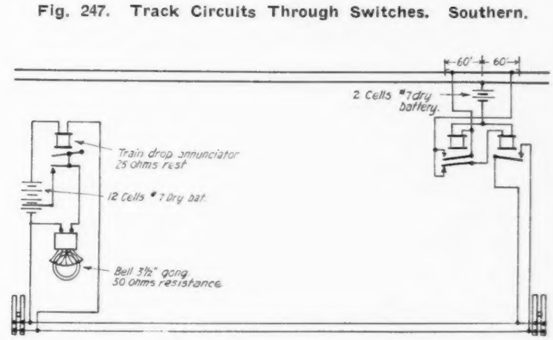


Fig. 248. Circuits for Drop Annunciator. Southern.

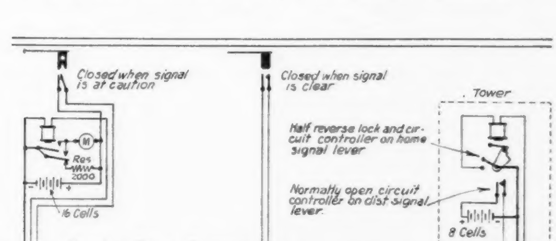


Fig. 249. Circuits for Power Operated Distant Signal with Indication Lock. Southern.

not be less than 1 in. above the surface of the ground. Corners to be rounded off inside to 1 in. radius at all angles and junctions. At signal and relay boxes trunking to fit tight and well under the case. Battery chute risers to be secured to chute, mitered and capped, cap to clear lid of chute ¼ in. Trunking on poles to end 6 in. below signal cross-arm, mitered and capped on top. Trunking shall be supported by stakes as large square as the trunking is wide at intervals not greater than 6 ft. Trunking shall be painted with two coats Avenarius Carbolineum."

Railway Signal Standards No. 11—The Boston Elevated.

This road is operated by electric motors taking direct current of 550 volts pressure from a third rail. Signals are of the electro-pneumatic semaphore and light type, the former being used on the elevated structure and the latter in the tunnels. The semaphore signals operate in the lower quadrant in two positions. The stroke of the arm is 60 degrees. In the Washington street tunnel electro-pneumatic dwarf signals without arms are used, in the East Boston tunnel simple light signals are used. Night color indications are green for clear, yellow for caution, red for stop.

On the elevated structure and in the Washington street tunnel direct current track circuits are used, in the East Boston tunnel, a. c. two rail return, 60 cycle circuits.

No batteries are used except for interlocking plants, and there is no pole line. The d. c. signals are operated through resistance from a 110 volt power line, track circuits about 1,200 ft. long. The a. c. signal control circuits are supplied from 500 volt, 60 cycle mains stepped down to 50 volts. Track circuits are about 1,000 ft. long with about 1 volt at the relay. Blocks are usually the same length as the track circuit. Overlaps are used with the d. c. signals, but not with the a. c. Automatic stops are used throughout.

Signal circuits are carried in wires in ducts in the tunnels and on the elevated structure in cables suspended from messenger wires. The common is not broken. Ducts are of iron pipe or vitrified clay. Some wooden trunking is used on the elevated structure.

The resistance of d. c. track relays, all of which are polarized, is 50 or 100 ohms in the track coils and 800 or 1,000 ohms in the polarized coils. Contacts are not enclosed. The a. c. relays are of the vane type, for single-phase circuits. Two rail return double impedence bands are used throughout the a. c. system.

Signal control wires are No. 14 B. & S. gage rubber covered copper, a. c. feeders, No. 6 B. & S. gage stranded rubber covered copper, extra heavy insulated with triple braid; d. c. feeders are No. 0 B. & S. gage stranded rubber covered copper. Bootlegs fot d. c. are No. 8 W. G. galvanized iron and leads from track, No. 14 B. & S. gage stranded rubber covered copper.

The standards are illustrated in the cuts shown herewith in which Fig. 250 is the blade and arm; Fig. 251, automatic stop trip on straight track, showing location in reference to train, etc.; Fig. 252, the same in tunnel, with apparatus on car; Fig. 253, the same, with trip about to engage; Fig. 254, the same, with signal in a nitch; Fig. 255, the same on elevated structure showing also the automatic signal and air connections; Fig. 256, circuit for stop without overlap; Fig. 257, circuit for home and distant signal; Fig. 258, wiring of automatic block signal; Fig. 259, circuits and wiring for two consecutive signals, one of which is at stop; Fig. 260, typical d. c. track circuit connections; Fig. 261, typical a. c. track circuit; Fig. 262, circuit for signal repeater; Fig. 263, polarized relay; Fig. 264, insulated rail joint, note raised threads on bolt, hexagon nut and long bushing passing through rail; Fig. 265, motor-generator switchboard for feeding track circuits, signal control circuits, and storage battery for interlocking.

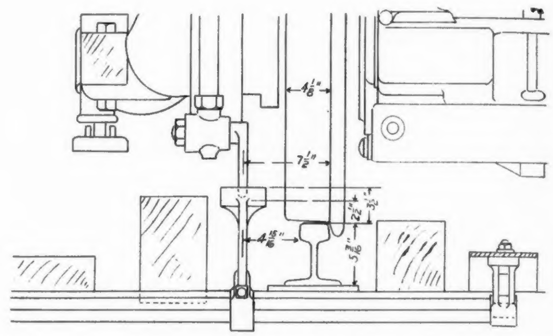


Fig. 251. Automatic Stop on Straight Track. Boston Elevated.

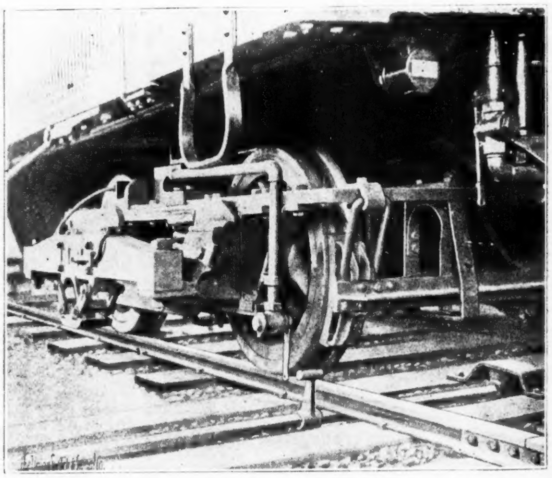


Fig. 252. Automatic Stop in Tunnel. Boston Elevated.

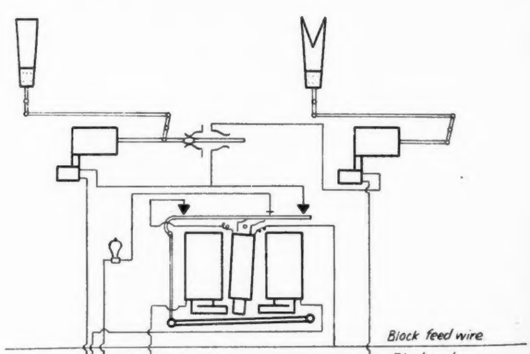


Fig. 257. Circuits for Home and Distant Signals. Boston Elevated.

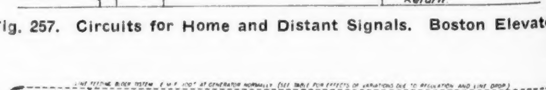


Fig. 260. Typical D. C. Track Circuits. Boston Elevated.

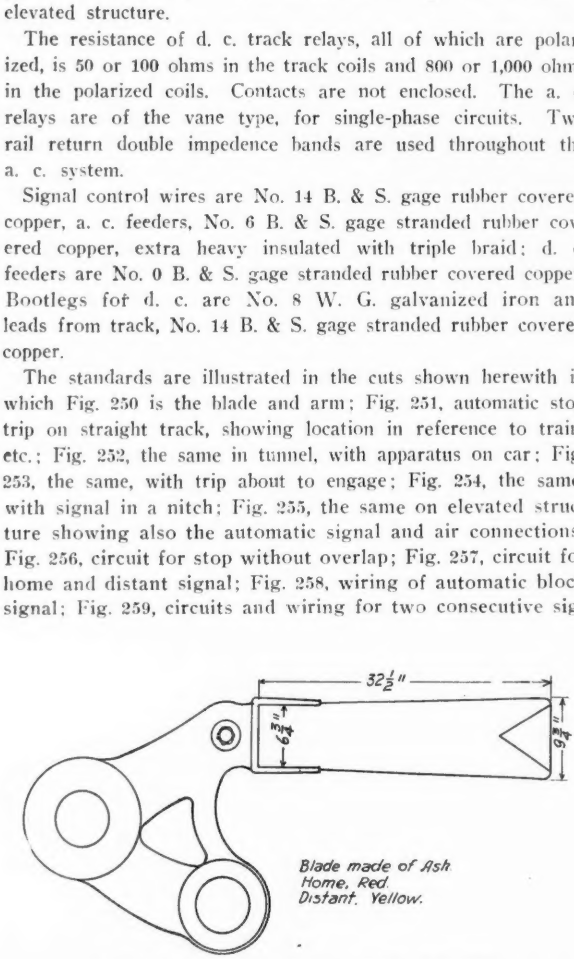


Fig. 250. Blade and Arm. Boston Elevated.

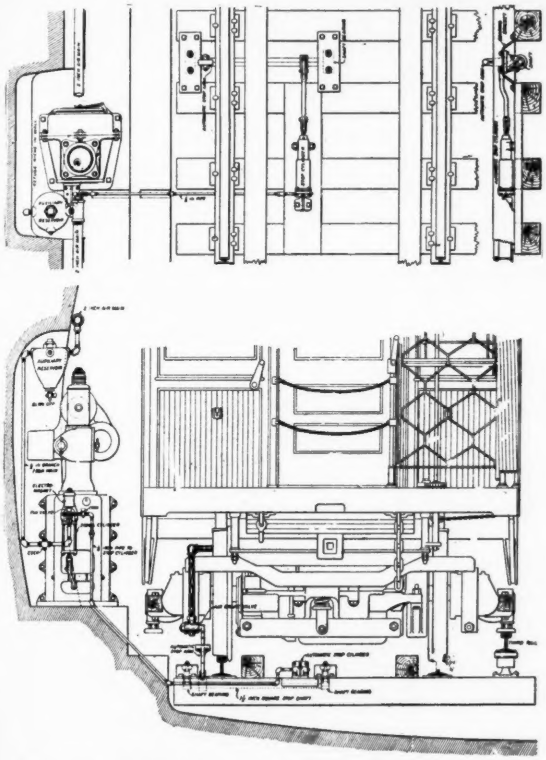


Fig. 253. Automatic Stop in Tunnel. Boston Elevated.

Fig. 254. Automatic Stop in Tunnel. Signal in Niche. Boston Elevated.

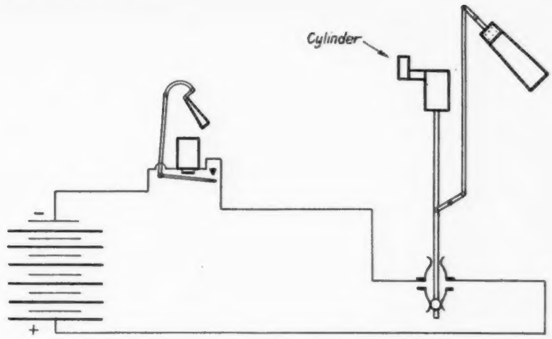


Fig. 262. Circuit for Signal Repeater. Boston Elevated.

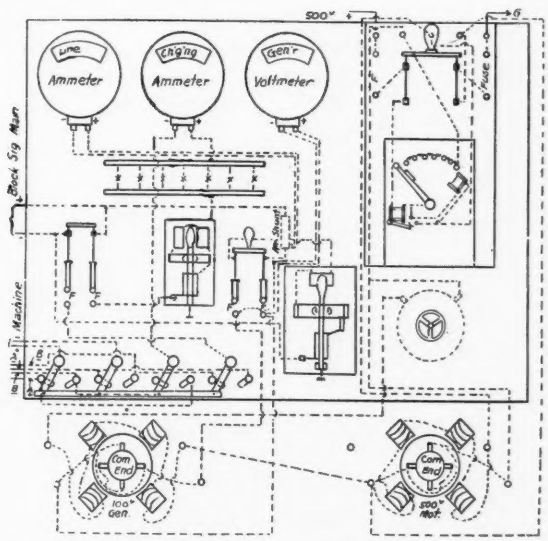


Fig. 265. Motor-Generator Switch-Board. Boston Elevated.

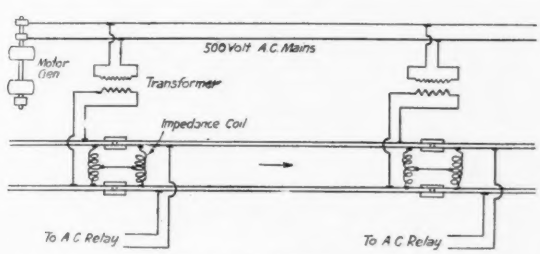


Fig. 261. Typical A. C. Track Circuits. Boston Elevated.

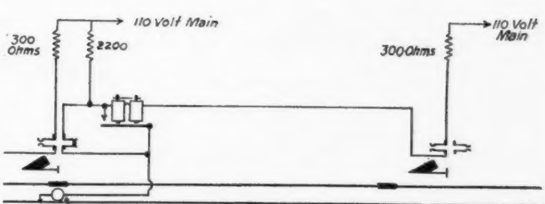


Fig. 256. Circuit for Stop Without Overlap. Boston Elevated.

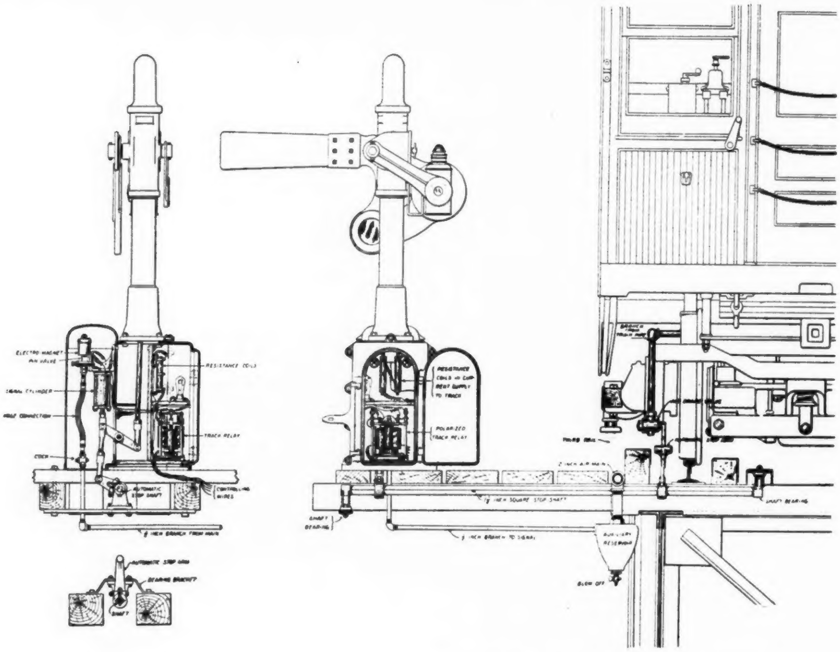


Fig. 255. Automatic Block Signal and Stop on Elevated Structure. Boston Elevated.

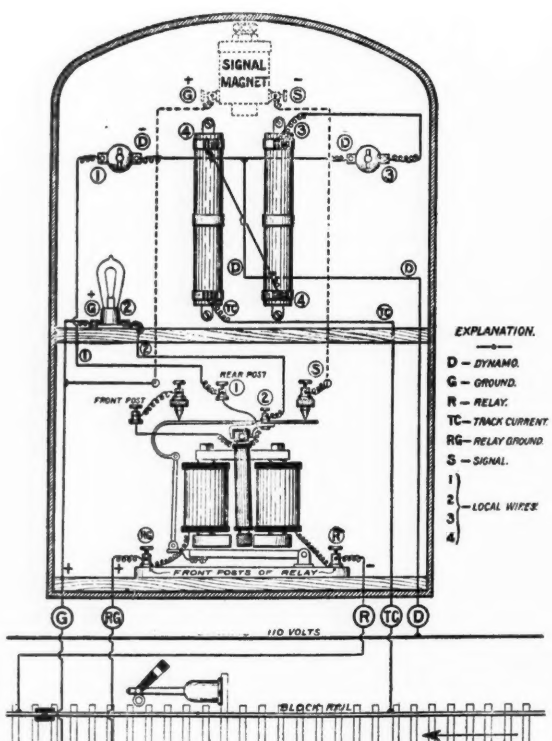


Fig. 258. Wiring of Automatic Block Signal. Boston Elevated.

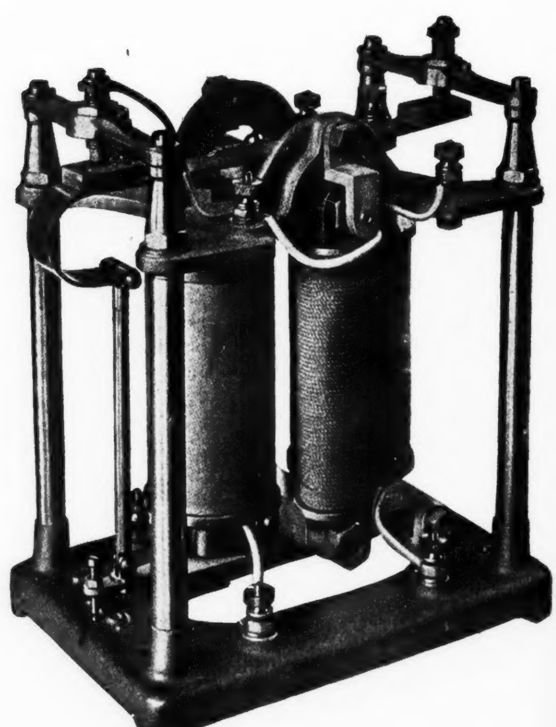


Fig. 263. Polarized Relay. Boston Elevated.

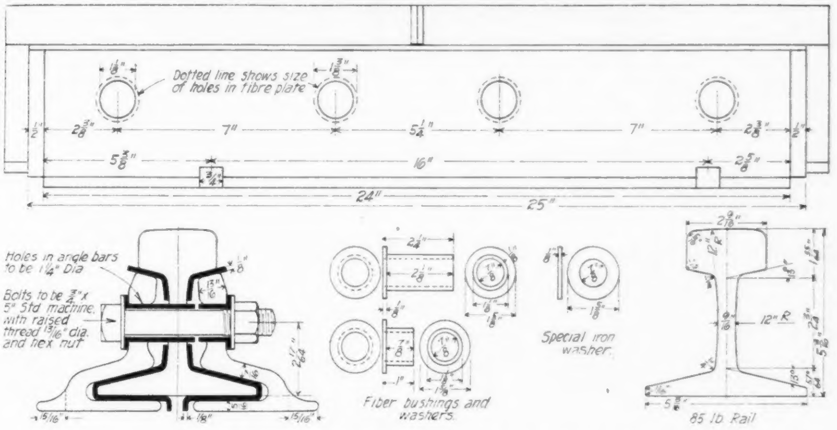


Fig. 264. Insulated Rail Joint. Boston Elevated.

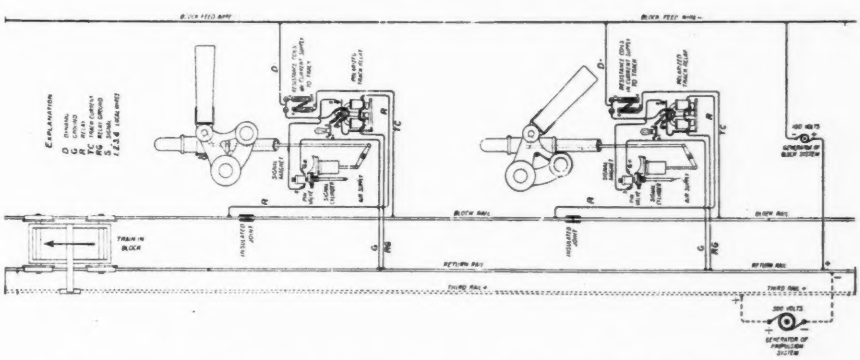


Fig. 259. Complete Typical Automatic Block Signal Circuits. Boston Elevated.

RAILWAY SIGNAL ASSOCIATION.

The advance notice of the annual meeting at Richmond, Va., in October, contains a considerable number of proposed amendments to the constitution, and the reports of the committees on mechanical interlocking, on power interlocking, on electrical signaling for electric railways and on automatic stops and cab signals. A separate supplement, filling 183 pages, contains an elaborate index to signal literature, which has been prepared by a special committee for the promotion of signaling education, of which W. J. Eck, of the Southern, is chairman, and A. D. Cloud, of the Signal Engineer, is vice-chairman. The principal items in the order of business for the annual meeting are as follows:

Tuesday, October 11.

10:00 a. m.	Opening.
11:15 a. m.	Proposed Amendments to the Constitution.
12:00 noon.	Mechanical Interlocking.
2:30 p. m.	Power Interlocking.
4:30 p. m.	Signal Practice.

Wednesday, October 12.

9:00 a. m.	Report of Sub-Committee on Standards.
10:30 a. m.	Automatic Block Signaling.
11:30 a. m.	Electric Signaling for Electric Railroads.
12:15 p. m.	Automatic Stops and Cab Signals.
1:30 p. m.	Adjourn for the day. Visit Exhibits.

Thursday, October 13.

9:00 a. m.	Wires and Cables.
10:45 a. m.	Storage Battery.
11:15 a. m.	Signal Failures.

With the index above referred to, Mr. Rosenberg sent out a circular in which the executive committee suggests that the work be printed as an independent bound volume, in cloth binding, separate from the proceedings, to be sold at, probably, $1.00.

The first change proposed in the constitution is one to divide the eastern from the western part of the country by a line through the middle of Lake Michigan and thence south along the eastern boundary of Illinois, instead of by a line through Buffalo and Pittsburg. This is proposed by T. S. Stevens, W. W. Slater and other western members. Following these are eight proposed amendments, all submitted by W. J. Eck, A. H. Yocum and other eastern men. First, they propose to do away with the necessity for dividing the country by enlarging the executive committee (to be called the Board of Direction). The board would consist of president, first vice-president, second vice-president, secretary-treasurer, eight directors and the three latest living past presidents. Four of the directors would be elected each year. As the first vice-president retired, after a two years' term, the second vice-president would take his place. It is proposed to have the nominating committee each year name members for the following year, and to have always on this committee three past presidents; the senior past president to be its chairman. The next amendment improves the provisions for nominating officers by letter ballot preceding the annual meeting. A paragraph is introduced allowing a voter to change his vote at any time before noon on the first day of the annual meeting. Another proposition is to give the Board of Direction the power to decide whether or nt an active member may retain his membership when he goes out of the railway service. Another requires the president to have the approval of the Board of Direction in selecting members of the standing committees.

The secretary presents an informal statement of the reasons for and against holding the annual meeting each year in Chicago in March.

FIGHTING FOREST FIRES.

Officials of the department of agriculture are predicting that the year 1910 will hold the record among many for the magnitude of the losses from forest fires. The summer fires followed a spring season believed to have been the worst, certainly in the Lake states, known for a long time. It is not wise to assume that the danger is over when the fierce conflagrations which have called forth in the Mountain states the efforts of three federal departments have been conquered. The forests will not be safe until the fall rains and snows have made a wet blanket of the dry forest floor. That the total losses of the year will run up to many mlilions of dollars is considered certain.

How such losses may be prevented in the future is a matter of general public concern. To the national forest timber burned must be added laorge amounts on state and private holdings, besides the immense damage done to tows, farm, and other property. Railroads have suffered from the interruption of traffic as well as from direct losses. The following is from a bulletin by Forester Henry S. Graves discussing forest fires and the proper methods of preventing and fighting them:

"In some secaions of the country forest fires have always been of such common occurrence that there is a popular notion that they can not be prevented. The risk from fires can never be entirely eliminated, for in the forest there is always inflammable material which is very easily ignited. They may, however, be largely prevented, and under efficient organization the resultant damage may be kept down to a very small amount. The problem is like that in cities, where fires can never be entirely eliminated, but where the risk of loss to property may be reduced almost to insignificance."

The importance of systematic provision for the early discovery of fires and for quickly assembling a properly equipped force of fire fighters at the scene of an outbreak is insisted upon by Forester Graves. "A careful supervision or patrol during the dry season," he says, "is one of the most important measures in organized forest protection. One of the fundamental principles in fire protection is to detect and attack fires in their incipiency." After pointing out the value of lookouts, telephone or signal communication and various methods of patrol, he goes on to tell how tc fight fires, as follows:

"The principles of fighting forest fires are essentially the same as those recognized in fighting fires in cities. The following are of first importance: (1) Quick arrival at the fire; (2) an adequate force; (3) proper equipment; (4) a thorough organization of the fighting crew, and (5) skill in attacking and fighting fires. Quick access to fires is accomplished through the work of supervision and patrol in discovering fires before they have gained much headway, and by a well-developed system of communication through the forest by roads and trails.

"A small fire may be put out by one man, but in extensive forests sevedal hours may pass before the fire can be reached. It is important to secure an adequate force of men and to get them to the fire quickly. In a well-organized system of patrol the guard who discovers a fire communicates quickly to other guards and to headquarters by telephone, signal, or other means, and indicates the number of men he needs.

"The efficiency of the fire-fighting crew depends very largely on their skill and experience, and particularly on the skill and experience of the man directing the work. It is not only a question of knowledge of how to place each man where his work will be most effective, but judgment must be exercised in determining the general method of attack. The character of the fire, the character of the forest, the condition of the atmosphere, the strength and direction of the wind, the rapidity with which the fire is running, and many other points have to be taken into consideration."

After describing how surface fires may be put out by beating, by throwing sand or loose earth, and by other methods, he continues:

"Sometimes the frnot of the fire is so fierce that it is impossible to meet it directly. One method under such circumstances is to direct the course of the fire. The attack is made on the sides near the front, separating the forward portion of the fire from the main wings. A part of the crew attacks the forward part and others run down and extinguish the wings. The front of the fire, attacked from the sides, is forced gradually and contsantly into a narrower path. Usually the front can be directed toward some cleared space, road, pond, stream, swamp, or fire line, when it will be checked enough to admit of a direct front attack. Sometimes by this plan the front may be rapidly narrowed by working from the sides, until it is at last entirely extinguished. The plan of giving direction to the course of the fire has often been successfully carried out when the fighting crew is too small for a direct attack.

"When fires gain such headway that it is impossible to stop them by direct attack, no matter how numerous and efficient the crew or compelte the equipment for fighting, back-firing becomes the only means of stopping the fire. It should, however, be used only when it is absolutely necessary. One of the commonest mistakes in fighting fires is to overestimate the rapidity of the fire and the difficulty of putting it out. A forest fire is always a frightening spectacle, particularly if it is sweeping in the direction of one's own property. Men often become excited and start back fires when it is entirely unnecessary. Back firing necessarily involves deliberately burning over property. When this belongs to another person and one's own forest seems in danger, there is a great temptation to sacrifice it.

"If it is found taht a back fire is necessary, a favorable point is selected directly in front of the fire, from which to set the new fire. This must be a point where it is safe to start a back fire, such as a road, fire line, stream, or swamp. The leaves are ignited at points five feet to a rod apart for a distance not gerater than the estimated width of the head of the fire. These small fires gradually meet and for ma continuous line, eating back against the wind. A part of the crew is stationed across the road or other break from which the back fire is started and put out at once the small fires which may result from the sparks blown over from the back fire.

"The meeting of the two fires stops at once the head of the main fire. It is usually possible then to attack the wings with the ordinary methods of fighting. It is necessary to attack the wings at once, particularly if there is a strong wind, for otherwise each wing of the old fire would soon form an independent fire with a well-developed head. It is necessary, also, that a number of men be stationed where the original fire and the back fire meet in order to extinguish smoldering fires in tops, logs, and other debris."

" A fire is never out," the bulletin concludes, "until the last spark is extinguished. Often a log or snag will smolder unnoticed after the fiames have apparently been conquered, only to break out afresh with a rising wind. After the fire-fighting crew has left the ground it is always well to assign at least one man to patrol the edges of the burned area until it is certain that the fire is entirely out. This may not be for several days."

The Bowe-Burke Company has taken a contract to do considerable work, consisting of culverts and small bridges, on the Canadian Northern extension into Duluth, and has already started work.

The Michigan Central tunnel, under the Detroit river, was opened for regular freight trains September 10.

With the Manufacturers

A NEW 50-WATT LAMP FIXTURE.

The Safety Car Heating and Lighting Company has recently developed an electric fixture, designed to use the G-30, 50-watt tungsten lamp. This fixture has many new features which commend its use.

The shade holding device illustrated in Fig. 2 is an enlargement of their 2¼ in. "Safety Shade Holder," fully described in the July issue of the RAILWAY ELECTRICAL ENGINEER, and demonstrates the wide range in practical usefulness of this form of holder.

Another feature, appreciated by the electrical engineer is illustrated in Fig. 3, which shows the interior portion of this fixture. The ornamental or exterior parts of the fixture, including the shade holder and shade, can be quickly removed without disturbing the electrical or interior parts. This feature also permits easy access to the electric wire connections and minimum labor when shopping cars and refinishing lamps.

The shade on this lamp is a triumph of the glass manufacturer's art, ensuring a brilliant illumination while completely diffusing the objectionable glare of the bare tungsten lamp.

The construction adapts this fixture to any design demanded by the interior finish of the car.

QUICK UNLOADING DEVICE.

Any person or corporation dealing in coal or other bulky commodities that have to be shoveled from car to wagon is interested in cost of transportation. He cannot do much in regard to railroad transportation; but how about the transportation from car to customer? If the usual practice is followed his driver drives a team to the car side and there the team is detained thirty minutes during process of loading. He wastes thirty minutes of valuable team time and if feed and other team expenses are high, it amounts to quite a sum each time a load is taken on and, as many loads are taken on every day, every month, and year, the loss if computed would be seen to amount to a large sum.

We illustrate herewith a device made by the Quick Unloading Car Chute Co., of Birmingham, Ala., which does not involve one cent of extra expense in loading to cut out all this loss by waiting teams. The steel chutes, hanging on the side of the car, Fig. 1, each holding a wagon load, are more easily filled than the wagons and with less waste. When a team arrives there is a load ready and in one minute the team is on the return trip. There is no delay, no lost team time. One team thus loaded hauls as much as two teams loaded old style. Some persons who have used the chute estimate a saving of $6.00 and over per car.

The following is an extract from a letter written by the freight agent of a prominent railroad to the makers:

"I am pleased to say that personally I think the chute an extremely good proposition for the reason that with proper management, the maximum amount of returns can be secured from both teams and men employed in unloading cars by a continuous service on the part of both. The matter of the actual introduction of these chutes is educational to a certain extent, and people cannot at once see the advantage of their use. I am pleased, however, to say that I have several people interested, one man in particular having a contract of hauling some 2,000 tons of slag on which he cut price slightly with the view of overcoming this cost by the use of the chutes."

The device is simple and its construction will be at once understood from the illustrations. Fig. 1 shows a wagon loaded, ready to be hauled away. The shovelers in the car can do their work while waiting for a team to arrive, and are thereby enabled to work continuously. There being no waiting for the wagon, or wagons waiting for loads, one-third more work can be done with a given number of teams.

Fig. 1.

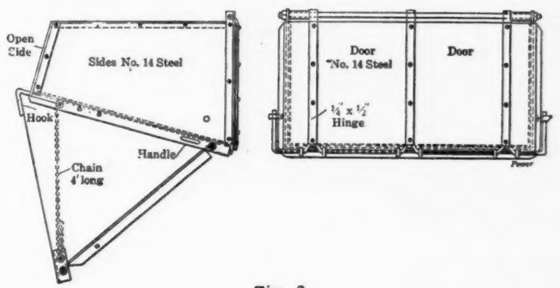


Fig. 2.

Fig. 2 shows the construction of the chute. It is made of sheet-steel angle iron and is hung to the top of the car by two large hooks, which may be attached to the bottom frame of the chute at three different points, according to the size of the wagon to be loaded. The chutes are adjusted by a chain, by the hooking up of which the front of the chute is raised, while by letting it down the chute is given a greater inclination.

The chute can be used on box cars as well as on gondolas, and can be handled by two men easily. By using two chutes in one car and dividing the distance, the shoveler can unload the car without moving the chutes.

By using this device a wagon will be detained only one minute and can then start on its return trip. If extra large wagons are used, holding more than one and a half cubic yards, the contents of two chutes can be placed in each wagon as illustrated in Fig. 1. The driver of the team adjusts the bolt which locks the door and discharges the load from the chute into the wagon, then leaves the door relocked and ready for the chute to be reloaded. When cars are regularly unloaded from private tracks, the chutes can be permanently mounted on supports at the side and the car placed in a position for unloading.

GOVERNMENT CRUISING NATIONAL FOREST TIMBER IN SOUTHWEST.

The United States Department of Agriculture has undertaken the task of estimating the present stand of saw timber on each township and section of national forest land in the states of Arizona, New Mexico, Arkansas, and Florida. It will probably take until the close of the year 1912 to complete the work, but when it is done the government's foresters will know definitely how much timber can safely be cut from the national forests in those states, and just where the timber is that can be most advantageously sold. When a forest has once been covered by such a reconnaisance, purchasers and forest officers can agree on negotiations for

timber sales, advertisements of the timber can be placed, bids made, and contracts let. Up to the present time, in Arizona, all the saw timber on the Coconino forest has been cruised, including the Grand Canyon division, all on the Prescott, more than half of the Sitgreaves, about one-fifth of the Apache; in New Mexico, the Gallinas division of the Lincoln, and half of the Pecos. Field parties are now at work in Arkansas on the Arkansas National forest, and in Florida on the Choctawhatchee.

President W. W. Finley, accompanied by a large party of officials of the Southern Railway, spent the afternoon of September 29 inspecting the tunnels and New York passenger station of the Pennsylvania. The visit of the Southern officials was made on the invitation of Second Vice-president Samuel Rea of the Pennsylvania. After inspecting the station at Thirty-fourth street and Seventh avenue, the party boarded a special train and was carried through the tunnels. Preceding the inspection trip President Finley entertained the visiting representatives at luncheon, at which President Finley expressed high appreciation of the courtesy of the Pennsylvania in affording this opportunity for the inspection, and he also paid a high tribute to the achievement of the Pennsylvania in providing facilities by which the Southern will be enabled for the first time to land passengers from all parts of the South in the center of New York city without a change of cars.

President Finley's party included Messrs. Charles Steele, Elbert H. Gary and George F. Baker, Jr., directors of the Southern; First Vice-president A. B. Andrews and Col. E. L. Russell, of Mobile, vice-president of the M. & O.; Fairfax Harrison, director of the Southern and president of the Monon; J. M. Culp, vice-president, Southern; H. D. Spencer, vice-president; H. C. Ansley, treasurer; A. P. Thom, general counsel; E. H. Coapman, general manager; A. H. Plant, comptroller; L. Green, freight traffic manager; S. H. Hardwick, passenger traffic manager; H. F. Cary, general passenger agent; Assistant General Passenger Agents J. L. Meek of Atlanta, J. C. Beam, Jr., of St. Louis, C. A. DeSaussure of Memphis, and A. S. Thweatt of New York; G. W. Taylor, W. M. Wells, D. W. Ium, of Washington; C. L. Harris, of Birmingham; G. R. Loyall, of Knoxville; B. G. Fallis, of St. Louis; H. E. Hutchens, of Greensboro; W. N. Foreacre, of Charlotte, N. C.; Secretary R. D. Lankford, of New York; J. C. Williams, of Washington; L. Foreman, of Atlanta; Vice-president J. B. Munson, G. S. & F.; Comptroller M. F. Molloy, of Q. & C.; Comptroller C. B. Hays, of M. & O.

The Pennsylvania announces the following awards for efficient track work for the passed year:

First prize of $1,200.00, of which $800.00 goes to the supervisor, and $400.00 to the assistant supervisor having the best line and surface between Jersey City and Pittsburg and Philadelphia and Washington, was given to supervisor George Goldie, Jr., and assistant supervisor R R. Nace, who have charge of the track from 62nd street, West Philadelphia, to Wilmington.

Four premiums of $800.00 each, of which $600.00 goes to the supervisor and $200.00 to the assistant supervisor having the best line and surface on a main line superintendent's division between Jersey City and Pittsburg and Philadelphia and Washington, were awarded as follows: supervisor W. F. Rench and assistant supervisor S. L. Church, who have charge of the track between Girard avenue bridge, West Philadelphia, and Tullytown, Pa.; supervisor G. R. Sinnickson and assistant supervisor H. A Gass, who have charge of the track between Woodbine avenue, West Philadelphia, and a point just west of Coatesville; supervisor J. A. Burchenal and assistant supervisor E. C. Silvius, who have charge of the track between Durward and Longfellow, Pa.; supervisor F. L. Pitcher, and assistant supervisor W. W. Hubley, who have charge of the track between New Florence and George Station on the Pittsburg division. The Improvement premium of $1,000.00, of which $700.00 goes to the supervisor and $300.00 to the assistant supervisor showing the greatest improvement in line and surface on the main line between Jersey City and Pittsburg and Philadelphia and Washington was awarded to supervisor H E. Waters and assistant supervisor Frederick Evans, who have charge of the track between Baltimore and Springfield, Md.

L. W. Craus has been appointed inspector of motor cars and gasoline engines for the maintenance of way and structural department of the Chicago, Rock Island & Pacific. This appointment was effective September 1, 1910. Mr. Craus reports to the general manager, and has authority to inspect all gasoline equipment on the road and to pass on all the repair parts and new equipment purchased. He is also an instructor in the care of this kind of equipment. His headquarters are at Topeka, Kan.

C. E. Brisner, supervisor of the Pennsylvania Railroad, has been appointed division engineer of the New York, Philadelphia & Norfolk, with office at Cape Charles, Va., and J. H. Martin has been appointed foreman of signals, with office at Pocomoke, Md.

The different divisions of the Pennsylvania Lines East of Pittsburg have started signal schools where experienced signalmen give instruction to the division signal employes in regard to the proper operation and maintenance of the different signal and interlocking appliances. The importance of this step is indicated by the fact that, whereas in 1902 there were but 7,891 interlocking functions in operation on the lines east of Pittsburg, in 1908 this number was 20,725, having just about tripled in a period of six years. These 20,725 functions are operated by 8,792 levers. A total of 12,408 signals are in service, covering 3,385 miles of road, or over 70 per cent of mileage.

The Indiana Railroad Commission entered an order on August 26 calling upon the roads in the state of Indiana to report what progress they have made toward the installation of the block signal system of train operation, which was ordered by the commission some time ago under an Act of the General Assembly of 1909, requiring the installation of the block system. The general order became effective July 1. The recent order to report progress stipulates that the roads shall make a report within ten days. Copies of the order were sent to the eighteen roads within the state which were affected by the Act of the General Assembly.

The Middle Tennessee Railroad is preparing to extend its line from Leatherwood, Hickman County, to Mt. Pleasant, Tenn., a distance of 37 miles. The proposed extension will be constructed at a cost of $350,000, including an iron bridge over Duck river. The town getting the new line has subscribed $100,000 toward its construction.

On Friday morning last car ferry No. 18 of the Pere Marquette Railroad, bound from Ludington, Mich., to Milwaukee, fully loaded with freight cars, sank in the middle of Lake Michigan, and 27 persons were drowned. Fourteen of these appear to have been members of the crew, including the captain and most (or all) of the officers; two were stowaways, and the rest passengers. Car ferry No. 17 was near by and the men of its crew succeeded in saving 15 of the crew of No. 18. Boat No. 17 had been brought to the scene by a wireless telegraph message. The cause of the disaster is a mystery. Besides the 27 persons mentioned, two of the crew of No. 17 lost their lives in trying to rescue the men of No. 18.

The office of C. S. Thompson, superintendent of bridges and buildings, Colorado lines of the Denver & Rio Grande, has been transferred from Pueblo, Col., to Denver.

The following officers of the St. Louis Southwestern have had their authority extended over the Central Arkansas & Eastern, a new line building in Arkansas: C. D. Purdon, chief engineer; J. S. Berry, superintendent of bridges and buildings, both with offices at St. Louis, Mo.; T. E. Adams, superintendent motive power, Pine Bluff, Ark., and W. J. Williams, superintendent of telegraph, Tyler, Tex.

F. H. Alfred, formerly assistant to the president in charge of the engineering department of the Cincinnati, Hamilton & Dayton, has been appointed general superintendent and will continue in charge of engineering matters.

The New York, Philadelphia & Norfolk has been divided into two supervisor's divisions. E. C. Young has been appointed supervisor of division A, with office at Cape Charles, Va., and U. F. White has been appointed supervisor of division B, with office at Salisbury, Md.

Charles E. Brinser, division engineer of the New York, Philadelphia & Norfolk, with office at Cape Charles, Va., was born on December 3, 1881, at Elizabethtown, Pa. Mr. Brinser was educated in the high school of his native town and at Franklin and Marshall academy. He began railway work on April 9, 1900, as a rodman on the Pennsylvania Railroad, remaining in the construction department for about two years, when he was appointed rodman in the maintenance of way department at Philadelphia. He was appointed transitman in March, 1903, and from September of the same year until April, 1907, he was assistant supervisor of the Amboy division, the Monogahela division and the Philadelphia division. He was appointed supervisor of the Delaware division of the Philadelphia, Baltimore & Washington in April, 1907, which position he held at the time of his recent appointment as division engineer of the New York, Philadelphia & Norfolk.

Henry Connell has been appointed a roadmaster of the Oregon Railroad & Navigation Company, with office at La Grande, Ore., succeeding C. McCann, resigned.

L. B. Wickersham, vice-president and general manager of the United Railways Company at Portland, Ore., has been appointed chief engineer of the Oregon Electric, reporting to the president.

A second Lidgerwood plow car was put in operation by the St. Louis, Brownsville & Mexico Railway Company north of Vanderbilt, Tex. Six work trains now cover the territory between Bay City and Refugio and by November 15 it is expected the work of reconstructing the road between Algoa and Kingsville will be completed. Eighty-pound steel is being used to replace the present 63-lb. rails on the main line. The latter is to be used in the building of new lines, notably the line from Kingsville to San Antonio and the Brownsville belt line through the sugar cane district of the Rio Grande Valley. Work on the Collegeport extension is to be rushed to completion within the present month.

Two-thirds of the work to be done in the building of the Evansville, Mount Carmel & Northern railroad has been completed and trains will probably be running over the line by January 1. The work in the construction of the grade for the new line is going on well and the work of constructing the abutments for the bridge which will span the Wabash river at Mount Carmel is progressing rapidly.

E. S. Heyser has been appointed trainmaster of the Third division and the Hidalgo branch of the St. Louis, Brownsville & Mexico, with office at Kingsville, Tex., succeeding W. J. Carnohan.

J. W. Storrs has been appointed consulting engineer of the Montpelier & Wells River, with office at Concord, N. H. Mr. Storrs will have full supervision of construction and maintenance of bridges.

In a wreck due to a washout on the Chicago, Rock Island & Pacic at Clayton, Kan., on the morning of September 23, 16 persons, the majority of them passengers, were killed and 13 injured. The locomotive and the mail car of the train ran, without warning, into a flood 20 feet deep, which had been formed by a cloudburst. A fill 1,000 feet long had been badly washed. Parts of the wreck, in which were some of the passengers, were carried off some distance by the raging stream, and the passengers were drowned. The conductor, the engineman, the fireman and one brakeman were among the killed.

Near Tipton, Ind., last Saturday a butting collision of electric cars on the Indiana Union Traction line killed three passengers and a motorman and injured a half dozen other passengers. The passenger car, northbound, carried 30 or 40 passengers, but the southbound car was a freight. Every passenger in the smoking compartment of the passenger car was killed. The southbound car had run past the proper meeting place. The collision occurred almost exactly three days after the similar disaster near Bluffton, about 50 miles away, where 40 persons were killed.

P. E. Stevens has resigned his position as assistant engineer in the bridge department of the Great Northern and has taken a position with the firm of Butler Bros., general contractors, St. Paul, Minn.

L. B. Wickersham, formerly general manager of the United Railways, has been appointed chief engineer of the Oregon Electric Ry., and is succeeded by Mr. C. A. Coolidge.

C. H. Fisk has been appointed chief engineer of bridges, buildings and construction for the Chattanooga Southern R. R., with headquarters at Chattanooga, Tenn.

Henry B. Seaman, chief engineer of the public service commission of the first district of New York, has resigned.

SOMETHING NEW IN PAINTS.

One of the features of the Master Car and Locomotive Painters' convention at St. Louis was the series of tests on the paints of the Best Oil Co., 30 Church street, New York, con-

A. Conklin Knapp, Pres. & G. M. Best Oil Co.

ducted by B. F. Mueller, chemist for the company. Mr. Mueller is the very bright German who invented the substitute for linseed oil, which forms the base of the new paint.

The new oil forms a protection against corrosive action which seems practically perfect, and its application is as easy and simple as is that of the old style paints. The tests conducted by Mr. Mueller were of the severest nature and were calculated to show the resistance of the paint to both mechanical and chemical destructive agents. The pigments are so

well protected by the oil that the delicate shades of red and green seemed to show no change when subjected to the action of the strongest acids and alkalies.

Boiling hydrochloric, sulphuric and nitric acids were placed on tin protected by a coat of the paint, with no effect. An electrolytic test proved very interesting. Oxygen, produced by electrolysis, especially corrosive in the nascent state and which attacked and destroyed with rapidity metals exposed to its action, did not affect those protected by a thin coat of Bestol paint.

Mr. A. Conklin Knapp, manager of the railway department for the Best Oil Co., was the very genial representative in charge of the St. Louis exhibit.

INDUSTRIAL NOTES.

The Westinghouse Air-Brake Company, Pittsburg, Pa., has moved its Richmond, Va., and Cincinnati, Ohio, offices to Atlanta, Ga., the new address being Candler Building.

The United States Metal & Manufacturing Company, Chicago, has moved its office from the Railway Exchange Building to suite 1104-1105, McCormick Building, Michigan avenue and Van Buren street.

The Locomotive Superheater Company, of New York, has received orders for twenty-five superheaters each from the Chicago, Rock Island & Pacific and the New York Central & Hudson River.

The contract for the erection of the National Carbon Company's plant at Niagara Falls has been awarded to the Hunkin-Conkey Construction Co., of Cleveland, Ohio. The plant will have four one-story buildings and one five-story building.

The Bucyrus Vulcan Co., Evansville, Ind., has been incorporated to manufacture steam dredges, shovels, etc. The incorporators are: H. P. Eells, G. F. Steedman, W. W. Coleman, E. K. Swigert and Carl Horix. Capital stock, $600,000. This new company is the organization which has taken over the Vulcan Steam Shovel Co., of Toledo, notice of the purchase having been made some time ago. It was proposed at the time to remove the plant to Evansville.

J. G. White & Company, Inc., engineers and contractors, 43 Exchange Place, New York, have been awarded a contract by the New York, Ontario & Western Ry. for the erection of railroad shops at the Mayfield yards, Mayfield, Pa., near Carbondale. The work to be carried out consists of the erection of a ten-stall roundhouse, with a 75-foot turntable, machine shop, carpenter shop, with complete power plant, storehouse, office building, oil building, sand storage, drier and loading house, and a complete coaling station, with a storage capacity of approximately 1,000 tons. The buildings will be of the usual type of brick and steel construction. The estimated cost is approximately $150,000.

The Pittsburg Testing Laboratory, Pittsburg, Pa., has moved its New York office from 1 Liberty street to 50 Church street, and its interests in New York and in New England are now in the hands of Wm. F. Zimmerman, M. E., the second vice president of the company. Mr. Zimmerman reassociated himself with the company last spring.

W. N. Matthews & Brother, St. Louis, Mo., have bought a controlling interest in the Davis Expansion Boring Tool Company, St. Louis. The stock bought formerly was held by Alexander Landau and A. E. Leussler. W. N. Matthews will be president and treasurer of the company; Emery E. Davis, vice president, and Claude L. Matthews, secretary. The company's business will be increased and several new tools added to the line it handles, particularly an expansion reamer invented by Mr. Davis.

The Isthmian Canal Commission will receive bids until October 17 for hose, packing, torpedoes, diaphragm pumps, hose strainers, valves, cocks, grease and oil cups, lubricators, engine gongs, flue ferrules, scales, machinists' clamps, flue cleaners, squilgees, headlight glass, carbide, drawing paper, cover paper, etc. (Cir. No. 607.)

The Strong, Carlisle & Hammond Company, Cleveland, Ohio, has received an order from the Bengal & Northwestern Railway of India for Randall graphite sheet lubricator for use on 200 cars.

A. R. Wight, assistant resident engineer of the South Australian Railways, Quorn, South Australia, wants catalogues of materials used in the engineering department of American railways.

The Homestead Valve Co., has opened an office at 1135 Park Row Bldg., New York City, for the sale of valves in that territory. The office will be in charge of Frank Boyle who will carry a stock of valves for immediate delivery.

At a meeting of the directors of the Best Oil Co., A. Concklin Knapp was elected president and general manager of the company.

Among recent oil furnace contracts taken by Walter Macleod & Co., of Cincinnati, are, a large plate heating furnace for the J. Baum Safe Co., of Cincinnati, Ohio, complete furnace equipment for the Southern Motor Works, Nashville, Tenn., and a complete furnace equipment for the W. H. Clore Mfg. Co., Washington, Ind.

Judge Landis, in the United States District Court on September 21, appointed the Hibernian Banking Association as receiver of the West Pullman Car Works, which is alleged to have profited to the extent of $300,000 in padded car repair bills in the Illinois Central railroad conspiracy. A petition asking that the corporation be adjudged bankrupt was filed by Thomas F. L. Henderson. Fears that the State Bank of West Pullman and the Brownell Engineering Co., of Cleveland would foreclose mortages given by the concern caused the action.

John B. Milliken, comptroller of the Crocker-Wheeler Company, Ampere, N. J., has accepted a position as treasurer of the Yale & Towne Manufacturing Company, New York, with headquarters at New York.

To facilitate handling its rapidly increasing business in the Middle West, the Rockwell Furnace Company, New York, has opened a branch office in the Fisher building, Chicago, with A. L. Stevens, an experienced furnace engineer, in charge.

The Glacier Metal Company, of Richmond, Va., is placing on the market a new ribbonized plastic metallic packing for steam, air, water, gas, ammonia, etc. This packing is satisfactorily made, from an allloy of white metal, into fine shreds or ribbons, and is therefore very pliable. It will not score the rods nor show corrosion when in contact with acids.

The annual report of the Westinghouse Air Brake Company, New York, just issued, for the year ended July 31, shows net earnings of $4,653,102, as against $2,039,273 in 1909. After charging off $429,824 for depreciation, etc., a surplus of $4,223,278 remained, as against $1,920,557 in 1909.

Mr. George L. Sprague has resigned as supervisor of apprentices at the Dunkirk works of the American Locomotive Co., to accept a similar position with the Allis-Chalmers Co., at Milwaukee, Wisconsin.

The Hicks Locomotive & Car Works, Chicago, was, on September 19, placed in the hands of the Commercial Trust & Savings Bank, as receiver. The Chicago officers of the company explain that it has suffered, together with other railway equipment companies, in the slump of business during the last three years. The receiver will continue to operate the plant, and it is expected that it will soon be working full force.

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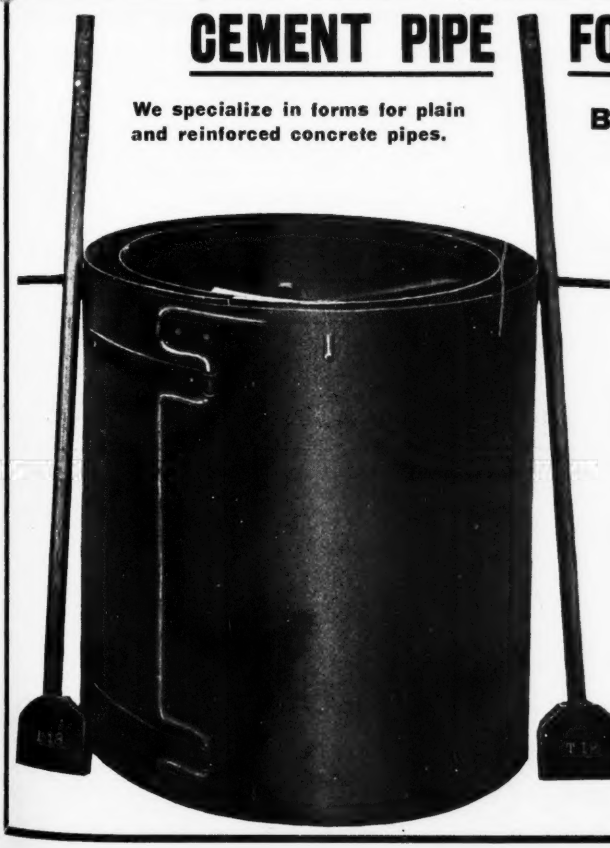

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